Coalescent community at Alsónyék: the timings and duration of Lengyel burials and settlement

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Alsónyék and the Lengyel culture in central Europe

The Lengyel culture was very widely distributed in central Europe in the first half of the fifth millennium cal BC. At its greatest extent, its settlements are found in western and north-east Hungary, south-west Slovakia, eastern Austria and the Czech Republic. Its distribution even reached Slovenia and Croatia in the south, and Poland in the north.

The Lengyel settlement at Alsónyék lies within a part of south-east Transdanubia where a series of Lengyel sites were already known, including settlements, concentrations of burials and enclosures — the product of research going right back to the late nineteenth century. The discovery of Alsónyék so close to other substantial Lengyel sites and the realisation of its great size have been major surprises.

The Lengyel occupation at Alsónyék

Nearly 9000 of the almost 15,000 features excavated at Alsónyék can be assigned to the Lengyel phase, including approximately 2300 burials, numerous pits and pit complexes, and 122 post-framed houses. It has been estimated that the entire site could have covered as many as 80 ha. The traces of Lengyel occupation can be seen over the entire excavated area. For the purposes of analysis here the relevant parts are subsites 5603, 11 and 10B (*fig. 1*). When the ToTL collaboration at Alsónyék began, the post-excavation

analysis of subsite 46 was not advanced enough for inclusion in the dating programme. Since the area contained only two houses and 55 graves (MAJERIK ET AL. 2010), its exclusion was not seen as problematic.

Lengyel features are completely absent in subsite 5603/2 (the area of Sopot occupation; OSZTÁS ET AL. this volume (a), *fig. 1*), and largely absent in the southern portion of subsite 5603, where there is the intense Starčevo occupation, and in the centre of the site. Although it is possible that the Lajvér stream in this area eroded Lengyel occupation levels down to the LBK archaeology, the minimal visible traces of Lengyel activity suggest that this area was avoided in this period. Ditch sections were observed and investigated at the outer limits of subsites 10B, 11, and 5603, to the north, south and east, respectively. With the rising ground of the Szekszárd hills only about 65 m to the west of the centre of the site, it is our view that these could form the limits of a coherent, bounded settlement.

Subsite 5603

Subsite 5603 forms the eastern axis of the site (area 6). A total of 2911 features were excavated in this area. From the Lengyel phase, nearly 2000 features including postholes associated with 26 houses and 625 burials were recorded (Grave Groups 42–59 plus scattered graves), covering an area of over 6.3 ha. The area can be divided into two parts: a long, thin eastern arm and a more rectangular southern portion that runs close to subsite 11 (*fig. 1*). The eastern section was the most densely occupied in the Lengyel phase and, with the exception of a few LBK settlement pits in its western end, only Lengyel features were observed here. The northern half of the southern portion of the area had traces of LBK settlement, but was otherwise densely covered with Lengyel features, whereas further south the area was densely covered with Starčevo features.

Subsite 11

Subsite 11 forms the southern axis of the site (areas 4 and 5), south of the bed of the Lajvér stream (*fig. 1*). Nearly 3700 features were excavated, covering 8.3 ha. About 1500 recorded features could be assigned to the Lengyel period, among them 23 houses with postholes and 735 burials (Grave Groups 60–92 plus scattered graves). In the northernmost part of the area there were LBK occupation deposits, while the more southerly portion was relatively densely settled in the Lengyel period. At the

southernmost part of subsite 11, a considerable number of features from the Late Iron Age and Early Roman periods came to light. Although a large number of excavated Lengyel burials were found in subsite 11, there were fewer buildings here than in 10B, though this might be due to circumstances of detection and survival. On subsite 11 the most common features are the extremely large pits or pit complexes, which are found across the whole site, except at its northernmost end. They are thought to have been used as clay extraction pits, although some may have had a natural origin. Several were investigated by test trenches, although due to the high groundwater level their full depth has not been established. Similar large features were excavated in the southern part of subsite 5603, containing mixed finds of different periods.

Subsite 10B

Subsite 10B is the northern axis, with a western arm, north of the bed of the Lajvér stream. A total of 7780 features were excavated from all periods (*fig. 1*). From the Lengyel phase, nearly 6000 features including postholes associated with 71 houses and 862 burials (Grave Groups 1–41 plus scattered graves) were recorded, covering about 9 ha. This is the most densely filled portion of the site, in particular in the northernmost sections where the houses form rows and, in some cases, intercut one another, showing signs of both refurbishment and reconstruction. The western arm of subsite 10B also appears to have dense Lengyel occupation (GALLINA ET AL. 2010, figs 6–7).

The visibility and excavation of features in the southern part of 10B (area 2) became increasingly problematic, largely due to high groundwater levels. Considerable numbers of features were excavated but many of these have simply been classified as indeterminate prehistoric, pending further evaluation of the ceramics. Many fewer traces of Lengyel occupation were found in the southernmost portion of 10B, compared to its northern part.

Burials and burial groups

There were substantial changes in mortuary practices in the Late Neolithic period. In the Early Neolithic in the Carpathian Basin complete skeletons or skeletal remains were interspersed amongst settlement features or buried in pits, usually without the concentration of graves in formal groups (BÁNFFY ET AL. 2010; MINICHREITER / BOTIČ 2010; PALUCH 2004; 2007). By the time of the central European LBK, there are

numerous cemeteries (BICKLE / WHITTLE 2013, 17), but in Hungary these are essentially missing from the LBK of both Transdanubia and the Alföld (OROSS / MARTON 2012; WHITTLE ET AL. 2013). The much lower number of burials in earlier periods compared to the Lengyel period is also striking.

Approximately 2300 Lengyel burials were uncovered at Alsónyék, distributed over nearly the entire excavated area. By comparison, the next largest Lengyel cemetery so far known is Zengővárkony-Igaz-dűlő (21 km west of Alsónyék), with 368 graves (DOMBAY 1960). Other larger and smaller Lengyel burial grounds are known within the Lengyel culture (ANTONI 1982; KALICZ 1985; NĚMEJCOVÁ-PAVÚKOVÁ 1986; ZALAI-GAÁL 2010), although this phenomenon is characteristic of only its eastern area of distribution (KALICZ 1985, 21; ZALAI-GAÁL 1988, 56; 2010, 10). In the western area of Lengyel occupation, these regular forms of burial are not present at all. With the exception of a small grave group at Friebritz-Süd (NEUGEBAUER-MARESCH ET AL. 2002; NEUGEBAUER-MARESCH / TESCHLER-NICOLA 2006), only solitary burials often deposited in settlement pits or special forms of mortuary treatment (*Sonderbestattungen*) have come to light in this area (BARNA 1996; NEUGEBAUER-MARESCH 1995, 93–9; NEUGEBAUER / NEUGEBAUER-MARESCH 2003; NEUGEBAUER / TRNKA 2005, 223; PODBORSKÝ 2004, 279–80; ČIŽMÁŘ ET AL. 2008, 83–7). The crouched inhumation rite dominates; cremations exist but were rare (KALICZ 1985, 33–5; ZALAI-GAÁL 1988, 70–1; 2010, 17–19; ZALAI-GAÁL / ÓDOR 2008; NEUGEBAUER-MARESCH 1995, 98–9; RUTTKAY / TESCHLER-NICOLA 1985; RUTTKAY 1987; ZÁPOTOCZKÁ 1998, 116, 127; ČIŽMÁŘ ET AL. 2008, 83–7; BISTÁKOVÁ / PAŽINOVÁ 2010).

In southern Transdanubia an E–W orientation of the corpse (head facing east, body lying on its left side) is most common (ZALAI-GAÁL 2010), in contrast to the more varied orientations found further north in the Transdanubian Lengyel. Although there are a few exceptions (e.g. Group 1 and 15), E–W is also the most typical orientation in the burial groups of Alsónyék.

Within the study of the Lengyel culture, it has often been claimed that settlements and burial grounds were separate and, at least within the eastern distribution of the culture, that graves fall into definable burial groups (WOSINSKY 1889, 331; DOMBAY 1960, 193; KALICZ 1985, 21; ZALAI-GAÁL 1988, 71; NĚMEJCOVÁ-PAVÚKOVÁ 1986, 143). A large

proportion of the Lengyel burials at Alsónyék were found in what appear to be spatially discrete groups, though it must be remembered that these are often somewhat artificial constructs. In some cases, these groups are both compact and clearly separated from other groups, but in others they are rather diffuse and spatially overlap or merge. It should be noted that burials occurred at different depths, and those found higher up, often without detectable grave cuts or pits, were only recovered because of careful, deliberate search. In many cases, the high groundwater level made not just full excavation but also basic observation of graves impossible. In other cases, graves were not visible at all because the colour of their fills was exactly the same as the topsoil, and only skeletal remains or grave goods turned over by the machine indicated the position of a burial.

A total of 92 grave groups have been identified. In practical terms, such classification is essential for handling the large number of graves and for easy identification of their location (*fig. 2*). On average, there were 25–40 burials in a group (for example, Grave Group 13), with some as large as 100 burials (for example, Grave Group 59). The overall extent was variable but on average the groups are 15–40 m in diameter. In a few instances, many of the burials within a group even appeared to form rows (for example, in Grave Group 61). Some of the grave groups (for example, Grave Group 56) were near a house and in seeming alignment with its long axis.

Not all graves were part of groups. A number of graves were scattered across the site. Additionally, many of these graves were cut or placed into the fills of pits that contained occupation debris from the settlement. Many of these, as observed in subsites 5603 and 10B, lacked grave goods and were placed with their faces pointing in a direction other than south.

The burials followed a more or less strict burial rite. Although slight differences were often noted in burial orientations, an overall coherence can be observed. With the exception of a few grave groups (for example, Grave Groups 1 and 15), the orientation of the burials was E–W, with the head to the east, but with faces to the south (at least in subsite 10B and 5603). The dead were laid to rest in a contracted position on their left side. Some of the burials were found in higher soil layers without any detectable grave cut. The forms of the graves varied considerably (*figs 3–5*). The most common were the oval-shaped pits; there were some rounded rectangular pits. A rectangular pit with

postholes in the four corners is a new type of construction within the Lengyel period first discovered at Alsónyék (*fig. 4*). The difference between these two types of grave is reflected in the richness of the grave assemblages rather than in any chronological distinction, with the post-framed ones often being better furnished (ZALAI-GAÁL 2008; ZALAI-GAÁL ET AL. 2012a). The four-post graves in subsite 11 are less numerous as well as less well furnished than those in the northern part of subsite 10B (GALLINA ET AL. 2010, tabs 29–32).

The overall level of furnishing of the graves is also highly variable. While graves with four-post constructions contained grave goods that are both greater in quantity and perceived value, within the oval-shaped graves there is a large range, from completely unfurnished burials to those that approach the scale of furnishing of the graves with four-post constructions. A typical grave assemblage comprised 1–4 pots and perhaps a stone or bone tool. The pottery types are fairly varied in shape and size and do not differ markedly from the ceramic material of other south-east Transdanubian Lengyel burials. The most characteristic types are the bowls and their variants: hollow-pedestalled bowls, cups, biconical vessels, tripartite vessels and Butmir-type pots (*figs 4–5*). Some vases or amphorae, as well as anthropomorphic and zoomorphic representations (SOMOGYI / GALLINA 2013), are also found.

Among the more lavishly furnished burials, the artefacts include not only more pots, but often also polished and chipped stone tools (such as axes, adzes and flint blades), copper ornaments and imported shell beads (*Spondylus* and *Dentalium*). At Alsónyék, the most typical types of *Spondylus* ornaments are arm rings and belts; there are also *Spondylus* pendants and diadem-like forms. *Dentalium* shells often occurred in combination with copper beads, as necklaces or bracelets. Copper was used only for ornamentation in this period, mainly as arm rings, finger rings and necklaces combined with *Dentalium* beads (*fig. 6*).

Demography

From the ca. 2300 excavated Lengyel burials, 862 from subsite 10B have so far been studied in detail (KÖHLER 2012; 2013). The evaluation of material from other subsites is ongoing, and that analysis will inevitably refine the view presented here. Nonetheless, although anthropological investigations of the numerous other excavated cemeteries of

the Lengyel culture have been presented in detail (ZOFFMANN 1968; 1969–1970; 2004; 2014), the Alsónyék burials have already significantly changed our understanding of Lengyel practices. Although the condition of the skeletal material is moderately poor, with many fragmentary and incomplete bones, the exceptional volume of excavated burials has opened up new bioarchaeological and social-archaeological perspectives.

The demographic analysis of 862 skeletons suggests that the mortuary profile of the Alsónyék community is unrealistic (*tab. 1*). Compared to normal expectations of pre-industrial societies, the proportion of neonates (<1 year) is far too low (1%), and consequently the life expectancy at birth is rather high (32.6 years). The proportion of Infant I (1–7-year-old) and Infant II (7–14-year-old) individuals is also low (9.1% and 8.0%). The low proportions of neonates and children in the cemeteries of Lengyel (and other prehistoric) communities are usual, however, and the data from Alsónyék are not exceptional. This phenomenon could be explained by the poorer preservation of their smaller bones or by the use of shallow graves for child burials, which were then destroyed by erosion, agricultural work or by the circumstances of rescue excavation.

Moreover, contrary to the expected values, the numbers of adult and mature individuals are almost equal (36.7% and 36.8% respectively), while very old individuals are practically missing from the cemetery (0.2%). The general or expected age distribution in prehistoric populations is that the proportion of children is close to 40%, while among the adults there are more younger adult (20–39 years) individuals, and fewer mature adults (40–59 years). The ratio of males and females is uneven, both at Alsónyék and in any other known Lengyel cemetery, almost all being characterised by a higher proportion of women (*tab. 1*). This could be the result of selective mortuary practices, polygamy, and the death of males far from the community (or to flaws in the traditional methods of sex determination).

Researchers have often assumed that the characteristic Lengyel pattern of smaller or larger grave groups in some way reflects kinship links between the deceased (KALICZ 1985, 22; NĚMEJCOVÁ-PAVÚKOVÁ 1986, 145; ZALAI-GAÁL 1988, 31, 77–80; 2010, 246–7). The analysis of the so-called hereditary anatomical variations in skeletal remains suggests relationships in a few cases (in some burial groups), but the demographic structure observed within several grave groups does not support this interpretation,

because of the low ratio of children and the unequal sex and age proportions of the buried individuals found close together. In part due to the differing excavation methods and soil conditions, the verification of possible kinship links within a probably incomplete grave group is not easy. Further progress in this issue can be expected from aDNA testing on a large sample of the skeletal material.

Detailed palaeopathological analysis shows a relatively low incidence of trauma, non-specific inflammations and degenerative articular diseases. As for haematological disorders, *Cribra orbitalia* occurred with a high incidence among children, which probably reflects iron deficiency in the diet. Among the adults, the most frequent alterations were enthesopathic deformities, primarily on the calcaneum and on the patella, which are generally considered to be markers of more active lifestyle. Some rare and significant diseases occurred too. These include cases of benign tumour and of so-called pathological birth. Two cases of deformities affecting the frontal ligaments of the spinal column suggest DISH (diffuse idiopathic skeletal hyperostosis); diabetes, obesity, a protein-rich diet and physical strain are among the possible causes of this condition (ORTNER 2003).

Beside these cases, the most important malady is the occurrence of the infectious disease, tuberculosis (TB). The classic deformations were found on an adult male skeleton buried in grave 4027 (Grave Group 13). The most characteristic alteration was observable between the 4th lumbar and 10th thoracic vertebrae, where the vertebral bodies collapsed and fused (*fig. 7*) (KÖHLER ET AL. 2013; 2014).

TB is caused by bacterial species belonging to the *Mycobacterium tuberculosis* complex. Ancient DNA analysis to diagnose TB DNA in the skeletal material was performed on the skeleton and on other individuals buried in this grave group (PÓSA ET AL. 2015). This investigation confirmed the occurrence of TB in the case of three further individuals. Moreover, during the ongoing anthropological examination we found more cases (without the so-called typical symptoms) relating to TB, such as traces of periostitis on the inner surface of the ribs, multiple cavities on the vertebral bodies, and characteristic lesions on the inner surface of the skulls, which suggest that the disease can be seen as endemic in the Alsónyék community. The significance of these results is that this is one of the earliest representations of this infection in the Carpathian Basin and in Europe as

a whole (KÖHLER 2012; MASSON ET AL. 2014). In the future, with the help of morphological and aDNA investigations, which can specify which member of the *Mycobacterium tuberculosis* complex caused the spread of the disease, we may be able to answer more of a list of still open questions (for example, whether human or animal bacterium infected the community, and how the disease can be connected to Neolithic lifeways, stock farming and the consumption of meat and milk).

Oral pathological examinations revealed a generally low frequency of carious lesions, alveolar abscesses and cysts, that suggests an adequate dental hygiene. However, the frequent appearance of dental hypoplasia suggests an unpredictable food supply in early childhood.

There had previously been no isotopic investigations of the diet of Lengyel populations, and this is the first time that a large body of such evidence can be discussed (see BAYLISS ET AL. this volume, 00–00).

Settlement and subsistence

Previous knowledge of Lengyel architecture was very patchy. In Slovakia and Austria, traces of post-built houses have been found, while various sunken structures or pits cannot be interpreted any longer as residential buildings (KALICZ 2003, 8; RACZKY 2005, 24; PAVÚK 2003, 464). The above-ground, timber-framed buildings at Zengővárkony, uncovered in the 1940s, were for a long time the only known examples in Hungary (DOMBAY 1960, 57–65, Abb. 17). A part of a building with bedding trench and an apsidal end excavated at Veszprém-Felszabadulás út, and dated to Lengyel III (RACZKY 1974), remains without parallel in Hungary.

Large-scale excavations in Hungary from the 1990s onwards opened up entirely new perspectives on above-ground timber-framed buildings, though their distribution in time and space remains uneven, and their dating is often uncertain. The rescue excavation in 2003 at Veszprém-Jutasi út (part of the same site as Veszprém-Felszabadulás út) yielded foundations of nine surface-level, timber-framed houses (REGENYE 2004; 2007). In Somogy County, a number of Lengyel sites with traces of post-framed buildings have recently been found (OSZTÁS ET AL. 2004; Krisztina Somogyi and Gábor Kocsis-Buruzs, pers. comm.). In Zala County, during the excavations preceding the construction of the

M7 motorway, remains of post-framed buildings attributed to the Sopot culture as well as to the early Lengyel culture have been uncovered at Sormás-Török-földek (BARNA 2011). Also connected to the rescue excavations in Győr-Moson-Sopron County and Vas County, the remains of a few buildings with bedding trenches have been interpreted as belonging to the late Lengyel (III) period (VIRÁG / FIGLER 2007, 360; ILON / FARKAS 2001.

It is Alsónyék above all which has provided exceptional new evidence (OSZTÁS ET AL. 2012). The remains of 122 above-ground, timber-framed buildings were uncovered, and other buildings are known (based on the evidences of the geophysical survey) to lie in the unexplored areas (RASSMANN ET AL. 2015). The majority of the house plans were incomplete, but well enough preserved for confident reconstruction (*figs 8–9*). Structural elements and foundations could be seen clearly in 34 houses, mainly in the northern part of the investigated area, in subsite 10B, where 49 house plans were observed. Here we found closely spaced buildings, most forming rows, many of which had been repeatedly renewed.

The houses at Alsónyék were all large, post-framed buildings with one or two internal partition walls (thus very different from the LBK tradition) and an open porch on the southern side. The houses all had a uniform north-north-west to south-south-east alignment, with slight variations across the entire settlement. The length of the buildings, including the porch, generally ranged between 14 m and 22 m, although a few were longer. Their width varied between 6 m and 8 m and they had rectangular or slightly trapezoidal ground plans (*fig. 8*). House renewal on the same spot was recorded in some cases in subsite 10B (area 1). The more sturdy construction of some partition walls and northern walls can probably be explained by the enlargement of buildings. In terms of their structure, the new buildings did not differ from the earlier ones, save in their dimensions (*fig. 9*).

The best parallels to the houses uncovered at Alsónyék come from nearby Zengővárkony and the buildings excavated at Veszprém, and they also share numerous similarities with Pavúk's Type 3a and 3b, even though the latter are usually larger and have a rectangular ground plan, while the Alsónyék buildings are smaller and slightly trapezoidal (DOMBAY 1960, Abb. 17; REGENYE 2004; PAVÚK 2003). The preliminary architectural assessment

of the buildings uncovered at Alsónyék suggests that there were no major changes in architectural practices during the settlement's occupation. The house plans at the site and their architecture appear to reflect a fairly uniform and consistent practice.

Associated with the 122 excavated Lengyel houses at Alsónyék was a range of pit features containing occupation debris. These ranged from small individual pits (about 3 m in diameter) to massive, poly-lobulated multi-use pit complexes (up to 25 m across) (*fig. 10*). In general, the fills of the pits contained a large quantity of broken pottery, stone and bone tools, grinding stones, and both articulated and disarticulated animal bones. Burnt daub fragments regularly occurred in the fill of the large refuse pits, providing additional proof that some structures had been destroyed by fire and, also, that the rubble had been cleared away and that the occupants had kept the house areas clean.

The nature of the deposits in the pits and their proximity to timber buildings suggest that the material is directly related to Lengyel settlement on the site. Although it is hard to associate specific pits with particular houses, in some cases there do appear to be strong spatial associations (these are highlighted in the text where the pit has been dated). The huge amount of ceramic material from the settlement pits is still being studied. Pottery analysis carried out so far shows no major differences in quality, technology, decoration and types between subsites 10B and 11. There is no information yet about the settlement pottery of subsite 5603. Pots from non-grave contexts appear to be more diverse in their types and sizes.

Great quantities of animal bones have been unearthed. Their analysis is also ongoing; 19,124 animal remains from 198 features from subsite 10B, area 1, have been studied so far (NYERGES 2013). The zoological finds were not heavily fragmented (88% of fragment lengths exceeded 5 cm), but only 62% of the bones were identifiable to species (NISP=11,785). The proportions of domestic and wild species is balanced; 53.8% originated from domestic and 46.2 % from wild animals. Beef (*Bos taurus*: 42%) seems to have dominated in the meat diet of the settlement. Sheep and goat (*Ovis aries*/*Capra hircus*) together make up only 4%, while pig remains (*Sus domesticus*) are only slightly more numerous (6%). The bones of dog (*Canis familiaris*) from settlement pits represent 1%, but dogs must have had a significant role within the community as seen in the complete dog skeletons or skulls discovered beside the deceased (ZALAI-GAÁL ET AL. 2011a). In

addition to remains of aurochs, mainly their horns, jaws of wild boar and their tusks as well as tools made from deer sometimes occurred as grave goods (ZALAI-GAÁL ET AL. 2012b, 70–5).

Most of the wild animal remains consist of aurochs (*Bos primigenius*: 21%) and red deer bones (*Cervus elaphus*: 17% skeletal bone and 1% antler). Together they are roughly equal in proportion to beef, which underlines the dominance of the consumption of large ruminants in the diet. Wild boar hunting (*Sus scrofa*: 6 %) was relatively common, but the remains of roe deer (*Capreolus capreolus*) are not significant (0.7% skeletal bone and 0.07% antler). The presence of fur-bearing mammals — bear (*Ursus arctos*), wolf (*Canis lupus*), hare (*Lepus europaeus*), beaver (*Castor fiber*) and other species — on the other hand, is minimal.

Molluscs were also found, but in markedly lower quantities than in the early Neolithic Starčevo settlement features. Remains of catfish (*Silurus glanis*), pike (*Esox lucius*) and the carp family (*Cyprinidae*) were also recovered.

All these archaeozoological data indicate a gallery forest with marshy areas rich in game, but which was also ideal for extensive livestock husbandry. Although such an environment was certainly home to numerous bird species, only a few fragmented bones of geese (*Anserinae*) or ducks (*Anatinae*) have been found. On archaeozoological grounds, meat consumption probably played a major role in the diet of the Lengyel people.

Although such a quantity of archaeozoological material is exceptional in Lengyel research, there are important, although smaller, comparative faunal assemblages from Zengővárkony, Pécsvárad-Aranyhegy and Villánykövesd (BÖKÖNYI 1959, 57–9; 1960; 1961; 1962). Bone tools have only been investigated in detail at Aszód (TÓTH 2013).

The wider Lengyel culture context

Previously, the span of the Lengyel culture in Hungary was conventionally estimated as covering 4900–4300 cal BC (e.g. KALICZ 2001, 9). Radiocarbon dates on seven human samples from Esztergályhorváti suggest that the beginnings of Lengyel culture can be dated to about 4990–4710 cal BC (BRONK RAMSEY ET AL. 1999, 202; BARNA 2007, 366–7). The mass grave of Esztergályhorváti represents the oldest, so-called formative phase

of the culture both in terms of relative and absolute chronology (BARNA 1996). The end of the Lengyel development can be connected to only a few radiocarbon dates on animal bones from Zalaszentbalázs-Szőlőhegyi mező; this was assigned to the latest Lengyel (III) on the basis of the pottery assemblage (BÁNFFY 1995a; 1995b; HERTELENDI 1995, 105–7). Two radiocarbon dates on short-life samples might suggest a date of ca. 4450–4370 cal BC for the decline of Lengyel culture in Hungary (OROSS ET AL. 2010, 397, Tabelle 2). There are only a handful of other radiocarbon measurements from Lengyel deposits in Hungary, all on unidentified charcoal (QUITTA / KOHL 1969; 1970; KALICZ / RACZKY 1987, 29). Usually there are only one or two measurements per site (FIGLER ET AL. 1997; ILON 2004, 27, fig. 26) and often the context of samples is unclear (OROSS ET AL. 2010, 397).

Over the wider distribution of the Lengyel complex, typochronological schemes continue to be refined. These are essentially based on traditional typological archaeological analysis of pottery, especially of changes in shape and decoration. There is much debate about these schemes, but the picture can be outlined roughly as follows. Hungarian research basically distinguishes three main periods (I, II and III) in Lengyel culture periodisation, mainly based on Pavúk's classification (PAVÚK 2007). The Lengyel culture emerged in its primary territory on the basis of the late LBK groups and the Sopot culture (issues of the chronology of the transition between the Sopot and Lengyel cultures are discussed in detail in OROSS et al. (this volume, 00–00). For the time being, based mainly on typochronological observations, it is very difficult to compare the varying Lengyel material culture of different regions, as far afield as Moravia and beyond (KALICZ 1974; ZALAI-GAÁL 2001b; 2002; ZALAI-GAÁL ET AL. 2014a; 2014b; SIKLÓSI 2010; VIRÁG / FIGLER 2007; PAVÚK 2007; DEMJÁN 2012; BARTA ET AL. 2013; STADLER / RUTTKAY 2007; KUČA ET AL. 2009; KALÁBEK ET AL. 2010). Only for the Moravian-Eastern-Austrian group (MOG) is the typo-chronology combined with series of radiocarbon dates (STADLER / RUTTKAY 2007). Carefully selected radiocarbon samples on short-lived material in closed contexts with diagnostic associations will be essential to unravel further cultural and chronological issues in the Lengyel culture. For Transdanubia at least, a programme is underway within the ToTL project to meet this goal.

Altogether over 300 Lengyel sites are known in Hungary, about half of which can be found in southern Transdanubia (ZALAI-GAÁL 2008, 243, Abb. 2). According to the

traditional classification, south-east Transdanubia (Baranya and Tolna Counties) belongs to the eastern distribution of the culture (KALICZ 1985, 12), and Alsónyék is in this region. This is one of the most intensively researched areas, beginning with the excavations on the eponymous site of Lengyel (Tolna County) (WOSINSKY 1891). Although numerous burials were unearthed here, neither the detailed archaeological record, nor most of the grave goods, nor the human remains have survived. From the 1930s a series of excavations on Lengyel sites, especially in Baranya County, began under the leadership of János Dombay. He investigated several important sites such as Pécsvárad-Aranyhegy (DOMBAY 1958), Villánykövesd-Jakabfalusi út mente (DOMBAY 1959) and Zengővárkony-Igaz-dűlő (DOMBAY 1939; 1960). Lengyel burial grounds were found by almost all these excavations, among which Zengővárkony with its 368 graves is exceptional (DOMBAY 1960). In Tolna County both extended field surveys (ZALAI-GAÁL 1982) and important excavations have yielded significant results. Notable are Szekszárd-Ágostonpuszta (ZALAI-GAÁL 1982, 7–9) and Pári-Altacker (TORMA 1971; ZALAI-GAÁL 1999), which also had burial grounds. The site of Györe is exceptional because of the presence of cremation burials (ZALAI-GAÁL 2000; ZALAI-GAÁL / ÓDOR 2008). In the 1970s, systematic excavations began at Mórágy-Tűzkődomb, 6 km west of Alsónyék (ZALAI-GAÁL 2001a; 2002). The finds from Mórágy created the basis for the wider analysis of over 600 burials found in south-east Transdanubia before the discovery of Alsónyék (ZALAI-GAÁL 2001b; 2010). According to this analysis, Lengyel burial started here in the Lengyel I period, but increased in scale during the Lengyel II period.

Apart from Lengyel, Zengővárkony and Mórágy, other excavations have opened only relatively small areas, with test trenches (some 100–1500 m^2), in which eight to 28 burials have been unearthed. Even smaller rescue investigations have produced one or two burials, such as Lánycsók in Baranya County (KALICZ 1977) and Kölesd-Lencsepuszta in Tolna County (ZALAI-GAÁL 1982, 11).

Following research by Zalai-Gaál (1990), intensive survey and mapping of Lengyel enclosures in Baranya County has been initiated. The remains of almost 20 Lengyel enclosures have been investigated in Baranya County, mostly using non-destructive survey techniques (BERTÓK / GÁTI 2011; 2014). Two of them (Szemely-Hegyes I and II) were investigated by test trenches and, based on the pottery, Szemely-Hegyes I can

probably be dated to Lengyel II (BERTÓK ET AL. 2008; BERTÓK / GÁTI 2011, 12; 2014, 63).

Despite field surveys in the neighbouring Somogy County (ZALAI-GAÁL 1982), there have been only a few large-scale excavations. Two enclosures (OSZTÁS ET AL. 2004; SOMOGYI 2007) and traces of a few post-framed buildings have recently been uncovered (OSZTÁS ET AL. 2004; Krisztina Somogyi, pers. comm.; Gábor Kocsis-Boruzs, pers. comm.). Generally we can say that sites which can be dated to the Lengyel II period predominate in Somogy County, but there are so far barely any detailed analyses of pottery assemblages (for example, for Kaposvár–Gyertyános: REGENYE 2011).

Although as a byproduct of these excavations several settlements have come to light, we have no relevant information about settlement layouts, partly because of the small areas excavated. Settlement material has barely been evaluated, let alone analysed in detail. For a meaningful history of the region during the earlier fifth millennium cal BC, we need far more information on architecture and mortuary practice.

On the basis of current knowledge, Zengővárkony is the only site which may have had a similar importance in the settlement network to that of Alsónyék. Its size is estimated at 40 ha. Except for a few burials from Zengővárkony and Györe, most of the burials investigated in southern Transdanubia appear to belong to the Lengyel II period. Alsónyék squarely fits the regional trend. The Lengyel burial grounds so characteristic for the eastern distribution of the culture are in sharp contrast with the western Lengyel area, thus cemeteries or even smaller grave groups were found neither in Vas and Zala Counties (see BARNA ET AL. 2015) nor on the Small Hungarian Plain (Győr-Moson-Sopron Counties).

Aims of the Alsónyék Lengyel dating programme

The aims of the dating programme are tied directly to better understanding Alsónyék, and its Lengyel occupation, as a Lengyel site of this scale was hitherto completely unknown. This is also the first time that Lengyel settlement and burial can be considered together. The scale and importance of the site lead to many research questions, some very specific and others more general. These include:

- What is the timing and tempo of settlement across the site? Was there a single fluorescence of activity, or did the site gradually grow? If the site grew over time, is it possible to determine those areas that were in use at the same time?
- Is there contemporaneity between the burial activity and settlement activity in areas across the site?
- What is the longevity of a single grave group? Were these groups used over a short period of time, potentially by extended family units?
- How did TB-affected burials relate to each other?

In order to investigate and answer these questions, it was necessary to develop a chronological framework focusing on the site at multiple levels. In doing so, it is possible to develop estimates for the start and end of activity associated with a single grave group, as well as an entire area, and finally the site as a whole.

Sampling strategy

Prior to beginning the radiocarbon dating programme, 'perfect pairs' of contemporary samples of human and terrestrial mammal bone from three burials (10B-3060, 10B-3472, and 5603-1821) were radiocarbon dated to check against the possibility of a freshwater reservoir offset. The statistical consistency of these results (BAYLISS ET AL. this volume, *tab. 1*) suggests that the consumption of freshwater resources has not led to a wide-scale freshwater reservoir effect in human bone samples from the site. Some particular individuals may have consumed a larger proportion of such resources, however, and thus exhibit a measurable freshwater reservoir effect. The stable isotopic analyses for each individual, which were used to estimate the percentage of fish in their diet (see BAYLISS ET AL. this volume, 00–00), attempted to identify and account for such individuals in the calibration process (see below).

As described by Bayliss et al (this volume, 00–00), we adopted a sequential sampling approach for the Lengyel activity at Alsónyék. Our initial intention was to achieve a generational chronology for the furnished burials on the site, using the relative sequence provided by a site-based seriation of the types of pottery in the grave assemblages as prior information for the model. Unfortunately, at the time of sampling, the construction of this seriation was only just beginning, using a sample of grave-assemblages from

subsite 10B, although during the course of the sampling programme it was extended to include a sample of grave assemblages from sub-site 11.

The first series of samples comprised approximately 20 burials from each of the three subsites, and was targeted at investigating questions relating to the overall use of the site and the potential for its growth and spatial development over time. This initial series not only attempted to cover the whole spatial area of Lengyel burials relatively evenly, but also targeted graves that were likely, on the basis of the preliminary analysis of the grave goods in advance of more detailed seriation work, to cover the whole temporal range of the graves. In addition a selection of graves was sampled where the skeletal remains showed signs of pathology, or the burial rite was outside of the norm, or the grave assemblage was sufficiently diagnostic that it was likely to fit into the site seriation as this was constructed.

After receiving the first-round results, preliminary modelling and simulation suggested that some grave groups might have been in use for only a few generations and that it might be possible to address questions relating to the timing or temporality of each group or a specific artefact type. Overall, however, burial in subsites 11 and 5603 did seem to persist for some centuries. The ceramic-based seriation had, however, still to be successfully constructed, although an additional seriation on stone axe-heads was now also under construction (ZALAI-GAÁL ET AL. 2014a). A limited number of grave groups were targeted, in each case sampling being concentrated on burials with stratigraphic relationships or with diagnostic grave assemblages that were likely to fit in either the ceramic-based or the axe-based seriations. These were:

- Group 14, in subsite 10B, because it had graves that contained diagnostic stone axeheads,
- Group 13, in subsite 10B, because it was the only group investigated with definitive cases of tuberculosis,
- Group 61, in subsite 11, because it was one of the largest, best defined and best furnished groups within the subsite,
- Group 68, in subsite 11, because the initial results suggested that burial in the area might have endured for longer than elsewhere,

- Groups 56, 57 and 59, in subsite 5603, again because burial in these areas also appeared to be longer-lived than elsewhere on the site.

In the new belief that burial at Alsónyék may have persisted in some areas, graves were selected that contained copper artefacts, especially heavy arm rings and multi-row necklaces, which are different from the more common necklaces made of shell and copper/malachite beads, and so were thought to be in later use.

As described in Bayliss et al. (this volume, 00–00), the second round of sampling of the Lengyel site at Alsónyék was not optimal, as it was based on the results of preliminary models that were subsequently found to be erroneous (following the discovery of the technical problem at Queen's University, Belfast). In particular, if the brevity of burial in subsite 10B (and to a lesser extent subsite 11) had been apparent at the time the second round of samples was submitted, the concentrated sampling of particular burial groups would probably not have been undertaken. It may also have been apparent that the search for chronological progression in a seriation where the vast majority of the graves were buried within a few generations around 4700 cal BC (see BÁNFFY ET AL. this volume, fig. 8) was doomed to failure.

Sampling of burials in the third round of submission was therefore targeted on managing the effect of the withdrawal of the initial series of dates from Belfast. The main focus of this submission, however, was the dating of the Lengyel settlement. A series of samples from settlement pits were submitted, in an attempt to discern whether there was any chronological difference in the use of the three subsites for settlement and burial, while also adding to the overall dataset to develop the chronological framework for the site. The most important element of the sample selection process was to ensure that the dated sample actually dates to the time of its deposition, and to do this meant that only bone that was articulated in the field or found to be articulating in post-excavation analysis could be considered. Armed with a pool of potential samples, it was then possible to select samples from pits that were spread across the site, had close associations with individual houses, and had stratigraphic relationships with other pits or human burials.

The samples and the structure of the models

The preferred models for the Lengyel occupation in each subsite at Alsónyék are defined in *figs 12–13, 15–16* and *18–19*. Each model estimates the chronologies of the burial and settlement activities in a subsite, using uniform prior distributions for the spread of each activity on each subsite (BUCK ET AL. 1992; BRONK RAMSEY 1995). As described above, more intensive dating was undertaken on a few grave groups and, to overcome the possibility of bias related to oversampling, groups with six or more dated burials were constrained within their own uniform prior distributions, which were then nested within the overall uniform phase of activity for the relevant burial phase. The effect of this approach is to reduce these larger sets of dates that may relate to an extremely short period of calendrical time to two effective parameters within the overall model.

Where a burial cuts into the top of a settlement pit it has been included as providing a *terminus ante quem* for the date of the pit (so that it only provides a constraint on the date estimates for settlement activity), but it has been included fully in the model for the burial activity.

For each sub-site a general outlier model (BRONK RAMSEY 2009, 1028) has been employed, which weights each radiocarbon date in accordance with its probability of being an outlier. Each radiocarbon date has been given a prior probability of 5% of being an outlier; the posterior probability calculated by the model of its being an outlier is shown on the relevant figure. So, for example, *OxA-27472: 11-679* has a prior outlier probability of 5% but a posterior outlier probability of 28% (*fig. 15)* and so has been downweighted in the model accordingly. The choice of this approach is discussed further below.

Subsite 5603

A total of 65 radiocarbon results are available from subsite 5603 (*fig. 11*, *tab. 2*). These come from 60 submitted samples, comprising 44 samples of human bone and 16 samples of animal bone. The human bone was from inhumations spread across eight grave groups (42, 52–54 and 56–59), with a further nine burials being ungrouped. The animal bone was from a total of 13 settlement pits and one tool made from red deer antler (Burial 5603-1821). Further details of the dated human skeletons and graves from each of the subsites are given in *tab. 5*. The chronological model for burial and settlement in subsite 5603 is shown in *figs 12* and *13*.

5603: southern. Six inhumations were dated from four grave groups (Groups 42 and 52–54) in the southern excavation of subsite 5603 (burials 62, 122, 253, 639, 677 and 927). All these samples were selected because they added to the overall spatial coverage of dating at the site and they also had axes that were initially in a seriation. Additionally, burials 62, 122 and 639 all contained copper beads.

5603: main. Four grave groups (56–59) are represented, and they have one (Group 58), five (Group 57), 10 (Group 59) and 13 (Group 56) burials dated respectively. The groups are discussed below in numerical order starting with Group 56.

Group 56. The 13 burials dated from Group 56 are relatively evenly spread across the approximately 35 burials that form the group. Of the 13, seven are not related stratigraphically to other dated features and the remaining six form separate sequences. Of the seven burials that are not stratigraphically related to other dated features (1996, 2000, 2579, 2580, 2597, 2599 and 2843), only 2580 and 2597 were in graves lacking four-post constructions. Burials 2599 and 2843 were relatively well furnished, with *Spondylus* and *Dentalium* shell ornaments. Burial 2580 was initially not placed into this group, as it is approximately 3.75 m north of the nearest burial, but it is in line with the easternmost row of burials and so has been included.

The first sequence has burial 1984 cut by burial 1988. The lower grave was well furnished and included *Spondylus* shell, a cattle (wild or domesticated) shoulder and the tusk of a wild boar, while the upper grave had a polished stone axe and an adze. The second sequence has burial 1989 cut by burial 2585. There are two measurements from burial 1989. The results are statistically consistent ($T'=0.2$; $T'(5\%)=3.8$; $\nu=1$; WARD/WILSON 1978) and have been combined prior to calibration to form mean 5603-1989 (5865±25 BP). The third sequence has burial 2906 cut by burial 2844. Burial 2906 was in a grave with a four-post construction.

Group 57. Group 57 lies a little over 10 m to the east of Group 56. Of the approximately 40 burials, five were dated; with one exception these are concentrated in the middle of the group. There are no stratigraphic relationships between the dated burials. Burials 1921 and 1969 contained copper rings and beads, while 1920 and 1934 were interesting

as these formed a potential double burial, since no relationship was observed that would indicate two separate grave cuts. Burial 1966 was of the four-post type, and contained six pots.

Group 58. Group 58 comprises six burials. It lies just over 6 m north of Group 59, and it is therefore feasible that these burials are associated with that activity. However, for the purposes of the modelling, the one dated burial from Group 58, burial 1881, has been kept separate.

Group 59. Group 59 is one of the largest and most spatially spread, and contains approximately 100 burials. Of these, ten have been dated that have a relatively even spread across the group. There is one sequence of burials, with burial 1877 being cut by 1875. All other dated burials are not stratigraphically related to other dated features.

There are two radiocarbon measurements on paired human and terrestrial mammal bones from burial 1821. These two results are statistically consistent (T'=1.7; T'(5%)=3.8; ν=1). Since the measurements are not from the same organism, they have been combined using the Combine function in OxCal. There are also two measurements from the skeleton in grave 1867, which are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1) and have been combined prior to calibration to form mean 5603-1867 (5869±25 BP).

Of the remaining six burials that do not have stratigraphic relationships with other features, only burial 1868 was in a grave of four-post construction. It also contained an anthropomorphic-faced pot (SOMOGYI / GALLINA 2013). Burials 2150, 2162 and 2222 all had copper arm rings, with the arm rings of the former two being quite substantial in size and weight. There are two results from burial 2162 that are statistically consistent (T'=2.0; T'(5%)=3.8; ν=1) and have been combined prior to calibration to form mean 5603-2162 (5705±26 BP). The final two burials, 2165 and 2226, were accompanied by an axe and one pottery vessel and three pots respectively.

Ungrouped burials. Nine further burials were dated across subsite 5603 and these all remain ungrouped. With the exception of burial 1535, all were dug into the settlement pits (noted below).

Settlement pits. Thirteen settlement pits spread across subsite 5603 were dated. These ranged in size from approximately 1 m to over 15 m in diameter. Seventeen radiocarbon dates are available from articulated or articulating animal bone in pits that are related to the settlement activity, with additional dates (noted above) coming from graves that cut the pits.

Eight dated settlement pits have observed stratigraphic relationships with dated burial pits. In five cases, the dated burials (2276, 1579, 1783, 1968 and 2770) are comfortably later than the pits into which they are cut (2256, 2257, 1716, 1931 and 2772 respectively).

Pit 2256 is a large settlement pit (ca. 14 m long) that was not excavated completely. There are two results from a cattle metapodium, which are statistically consistent ($T'=0.1$; $T'(5\%)=3.8$; $\nu=1$) and have been combined prior to calibration to form mean 5603-2256 (5693±20 BP). Burial 2276 was one of two graves cut into the top of the pit.

Pit 2257 is slightly smaller than pit 2256 and situated ca. 12 m further north. It has a stratigraphic relationship with only one burial which is dated, unfurnished grave 1579.

Pit 1716 is a large settlement pit (ca. 15 m long) that was cut by unfurnished burial 1783. The grave was cut into the upper layer of the pit, near the middle of its excavated portion. Four other, undated, graves were cut into the top of this pit.

Pit 1931 has an elongated oval shape (ca. 18 m long) and is situated between Groups 56 and 57. Burial 1968 was dug into the upper layer of the northern part of this pit, and contained two copper finger-rings and copper and *Dentalium* beads.

Pit 2772 is a small oval-shaped settlement pit (3 m in diameter). There are two results from a red deer carpal bone. The measurements are not statistically consistent at 95% confidence ($T'=4.2$; $T'(5\%)=3.8$; $\nu=1$). They are consistent at 99% confidence, however, and have been combined prior to calibration to form mean 5603-2772 (5740±17 BP). The pit is intrinsically interesting because it contained a large antler tine, fragments from an altarpiece and traces of fire. Also, it is cut by burial 2770, which is a double burial of two children (the older one of whom was dated).

In the remaining three cases where burials were recorded as cutting settlement pits, the dated burial appears to be anomalously old in relation to the date from the underlying settlement pit. Given the size of many of the settlement pits, and that some of them were clearly dug and redug over time, it is not completely unexpected that in at least a few cases the burials dug into the top of part of a large pit might predate material in a pit if the two sampled contexts are not located near one another.

Pit 2255 is the easternmost large pit from subsite 5603 and has an irregular oval shape (ca. 18 m long; *fig. 11*). It has stratigraphic relationships with eight burials of which burial 2262 is dated. It was dug into the northern edge of the pit and contained only one pot, and appears to have been buried before the part of the pit which produced the pig tibia dated by SUERC-52846 was infilled.

The radiocarbon date (SUERC-52837) from large settlement pit 1667 (ca. 15.5 m long and 13 m wide) is about 300 years younger than the date from burial 1798 (MAMS-20661), which was dug into its upper layer. In this case, again, it appears that the juvenile wild boar femur is from a part of the pit complex that was filled considerably later than the part that was cut by grave 1798.

Pit 1583 is an irregularly shaped pit (ca. 8.5 m in diameter). There are six graves that intercut with the pit, and unfurnished burial 1580 was chosen for dating. However, upon more detailed consideration of the archaeological record (site plans and photographs), it became clear that the edge of the burial was actually cut by the pit rather than *vice versa*. The radiocarbon result from the skeleton is earlier than the two results from different samples of articulating animal bone in the pit, which are statistically consistent ($T'=0.0$; $T'(5\%)=3.8$; $\nu=1$), and so this relative order is preferred and used in the model.

Five pits (1889, 1974, 2576, 2592 and 2827) have no stratigraphic relationships with other dated features. The result on an articulating dog humerus from pit 2576 dates from the last third of the sixth millennium cal BC (SUERC-52848) despite the fact that the pit contains Lengyel pottery. This may be the result of poor excavation whereby two intercutting pits were not identified separately. Whatever the reason, the result does not relate to Lengyel activity and has been excluded from any modelling. The two results

from articulating cattle and boar bones in pit 2827 are not statistically consistent (T'=7.0; T'(5%)=3.8; ν=1), and lend further support to the notion that many of the larger pits were probably used over a protracted period of time.

Only one radiocarbon date from subsite 5603 (*SUERC-52837:5603-1667*; O: 19/5; *fig. 13*) has a posterior outlier probability of more than 10%. This is no more than would be expected in a dataset of this size where all the data are compatible with the model presented.

Subsite 11

A total of 69 radiocarbon results are available from subsite 11 (*fig. 14; tab. 3 and 5*). These come from 62 submitted samples, comprising 45 samples of human bone and 17 samples of animal bone. The human bone was from inhumations spread across ten burial groups (60, 61, 66, 68, 71, 73, 76, 79, 83 and 88), with a further four burials being ungrouped. The animal bone was from a total of 16 settlement pits.

The demarcation of burial groups in subsite 11 is more tentative than in the other subsites. While there are clear cases of groups being tightly defined spatially, some even with identifiable rows of graves (such as Group 61), many are more ambiguous as will be noted below. The larger grave groups were found at the edge of the excavated area, and were not fully defined.

Group 60. Group 60, in the southern part of subsite 11 and close to Grave Group 61, is well defined spatially, with graves that sometimes form rows. There are approximately 30 graves in the group, of which two were dated (190 and 333). There are two measurements from burial 333 that are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1) and have been combined prior to calibration to form mean 11-333 (5805±23 BP). The grave is of possible four-post construction, and stands out as having copper rings and beads, as well as a polished stone axe, a belt of *Spondylus* shell and ten pots (GALLINA ET AL. 2010, tab. 37.2).

Group 61. Group 61 comprises Group 61A and Group 61B, with 61A being fairly well defined spatially with an indication of some rows of graves. The two groups are

presented here together, but are modelled separately. In total there are approximately 80 graves across the group.

Within Group 61A there is one dated grave sequence, with burial 293 cutting burial 228. There are another six graves (263, 264, 272, 295, 319 and 337) which form an arc across the north of the group and down its eastern side. In the burials of this grave group there were more than the average number of vessels, and 319 and 272 in particular (GALLINA ET AL. 2010, Table 37, 1) have large numbers of pots (9 and 11 vessels, respectively). Grave 337 has a four-post construction, and burial 319 may also have a structure of the same type.

Within Group 61B there are two dated burials (145 and 324). Both burials contain copper artefacts, with 145 having two copper arm rings.

Group 66B. One unfurnished burial (1850) has been dated from this grave group, as it cut settlement pit 1800 (see below).

Group 68. There are approximately 45 burials in Group 68, of which 19 burials have been dated. This group is less well defined than Group 61, on the western limit of the excavated area, becoming more diffuse at the edges and with little suggestion of internal structuring (that is, without discernible rows). The dated burials are spread relatively evenly across the group, with eight burials intercutting to form four sequences. The remaining burials do not have stratigraphic relationships to any other dated features.

Burial 679 is a child with no grave goods which was recorded as being cut by burial 724, which contained a jar and three other pots, and had only the mandible remaining. The result from burial 679 is too recent given the stratigraphic position of the body, and upon re-examination of the archaeological record the relationship is unclear. The stratigraphic ordering has therefore been removed from the model.

Burial 1191 is cut by burial 1192, which contains a *Taschengefäss* (ZALAI-GAÁL ET AL. IN PRESS). Burial 1793 contained a macehead, and is cut by burial 1860. Burial 1848 is cut by burial 1822. With the exceptions noted, these graves are all very poorly furnished.

The remaining 11 dated burials are not inter-stratified with any other dated features. Burials 699 and 1967 (GALLINA ET AL. 2010, Table 32, 4) are in graves of four-post construction and contain bone tools and flint in addition to pots. Burial 1184 contains a pot, a *Spondylus* pendant and a polished stone axe. The remaining graves (673, 808, 809, 815, 1189, 1190, 1802, 1808, 1822 and 1848) are all poorly furnished. There are two measurements from burial 1808 that are statistically consistent (T'=0.1; T'(5%)=3.8; ν=1), and have been combined prior to calibration to form mean 11-1808 (5878±24 BP).

Group 71. Group 71, along the eastern side of the excavated area, has approximately 50 graves, of which 3 have been dated. The group is similar to 61 insofar as there is a main area of the group, 71B, which has internal spatial structuring which suggests rows, or at least an even separation of the graves. However, the much smaller 71A has only five graves with no discernible patterning.

The dated grave in 71A (burial 743) is a possible four-post construction grave, with a polished stone axe, a flint blade and six pots. The two graves from 71B (1320 and 1391) are less than 3 m from one another in the southern part of the group. Burial 1320 is of the four-post grave type and contains seven pots, copper beads and a copper finger-ring (GALLINA ET AL. 2010, Table 30). There are two measurements from burial 1391 that are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1), and have been combined prior to calibration to form mean 11-1391 (5887±28BP).

Groups 73, 76, 79, 83 and 88. These groups lie to the north of those discussed so far. Burial 1235 (*fig. 5*) is one of nine graves in Group 73. In addition to six pots and polished stone adze, this burial also contained a grinding stone. Burial 1937 is one of the graves in Group 76, which is a relatively large group of approximately 55 graves. This particular burial was selected for dating because one of its well preserved pots was of a distinctive shape and had painted decoration that could possibly be included in the seriation, in addition to containing an axe. Burial 1669 is one of about a dozen that were grouped into the amorphous-shaped Group 79, and it contained seven pots. Also in this group was burial 1755, which was dated as it cut settlement pit 1625 (see below). Burial 2028 was one of two graves in Group 83. There are two statistically consistent measurements on the burial (T'=0.3; T'(5%)=3.8; ν=1), which have been combined prior to calibration to

form mean 11-2028 (5811±26 BP). Burial 2330 was placed in Group 88, which contained four other graves.

Burials not within groups. Burials 43, 275 and 1705 are cut into settlement pits and are discussed below. Burial 379, with three pots, an axe, a bone tool and a flint blade, was submitted because it was thought to cut pit 538, although reassessment of the site archive suggests that this relationship is insecure so it has not been included in the model.

Settlement pits. A total of 16 settlement pits were dated from subsite 11, and five of these pits (2, 208, 1388, 1625 and 1800) contained a sequence that ends with an inhumation cut into the top of the pit fills. The pits are relatively evenly scattered across the area where Lengyel deposits were excavated.

Pit 2 is one of the largest settlement pit complexes (minimum diameter of 13 m) in the subsite, and was not excavated fully because it extended beyond the western edge of the excavation limits. It was cut by two burials of which unfurnished burial 43 is dated.

Pit 208 is also a very large pit complex, which is situated at the southern part of the subsite, ca. 17 m to the east of Group 61. Its total diameter is ca. 15 m and it includes some other smaller pits. The northern part of the pit is cut by burial 275.

Pit 1388 is an approximately 25 m-long, irregularly shaped portion of a large pit that extended beyond the western edge of the excavation limits. It is cut by burial 1705.

Pit 1625, within the area of Grave Group 79, is a smaller settlement feature with oval shape (2.7 m in diameter). It is cut by Burial 1755 which contained two pots, a bone tool, a flint blade and an adze.

Pit 1800 is a small, oval-shaped pit (4 m long). It is cut by burial 1850, which has been assigned to Group 66B.

Eleven other settlement pits have radiocarbon dates, but are not stratigraphically related to other dated features.

Pit 1687 is the smallest dated pit (3 m long) and has two statistically consistent measurements (T'=0.1; T'(5%)=3.8; ν=1), which have been combined prior to calibration to form mean 11-1687 (5769±19 BP). Pits 2077, 1703, 1373, and 490 (4.5–6.8 m in diameter) each produced a single measurement on an animal bone sample. Pit 1502 is an oval-shaped pit (6 m long), with five graves situated to its southern side (Group 77). The two results from different groups of articulating animal bone in the pit are not statistically consistent (T'=4.3; T'(5%)=3.8; ν=1), and probably suggest some longevity to the deposit.

Pit 375 is approximately 5 m along its long axis, and part of a larger pit complex that includes Pit 538 and Pit 772 (ca. 6 m in diameter). These are situated between grave Groups 69 and 71. Pits 375 and 772 each produced a single result on articulating animal bone. Pit 779, which is an extremely large pit complex and includes other smaller pits, similarly produced a single measurement on a group of articulating animal bone.

Pit 538 is a large pit (*c.* 9.5 m in diameter) with two statistically consistent results on an articulating group of cattle bones (T'=0.3; T'(5%)=3.8; ν=1). A weighted mean has been taken before inclusion in the model, mean 11-538 (5753±20 BP).

Pit 1025, situated a few metres north of grave Group 68, is irregularly shaped and nearly 9 m long. It has two statistically consistent measurements (T'=0.0; T'(5%)=3.8; ν=1) on an articulating group of aurochs tarsals, which have been combined prior to calibration to form mean 11-1025 (5784±20 BP).

Four radiocarbon dates from subsite 11 have posterior outlier probabilities of more than 10%: two burials (*OxA-27472: 11-679,* O: 28/5 and *SUERC-53325: 11-293,* O: 31/5) and two samples from settlement pits (*MAMS-20674: 11-1502-3,* O: 17/5 and *SUERC-52832: 11-1703,* O: 21/5). This is no more than would be expected in a dataset of this size where all the data are compatible with the model presented.

Subsite 10B

A total of 83 radiocarbon results are available from subsite 10B (*fig. 17*; *tab. 4* and *5*). These come from 74 submitted samples, comprising 54 samples of human bone and 20

samples of animal bone. The human bone was from inhumations spread across 13 burial groups (1, 2, 5, 7, 8, 12–15, 18, 22, 23 and 26), with a further ten burials being ungrouped. The animal bone was from a total of 14 settlement pits or intercutting pit groups.

There are three non-Lengyel dates from subsite 10B. There is an Iron Age date from Pit 820 (OxA-27489), which cut Burial 819 and two Bronze Age results obtained from burials 10B-3461 and 10B-3463 (OxA-29026 and OxA-29027). These results have been excluded from the modelling (see BAYLISS ET AL., this volume, *tab. 9*).

Group 1. In Group 1 there are radiocarbon dates on four burials (4307, 7655, 7756 and 7753). Burials 7756 and 7655 are the two of the four not to contain copper artefacts, though the latter does contain an axe. There is a sequence of intercutting burials in this group, with burial 7753 being later than 7756. The two measurements from burial 7753 are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1) and have been combined prior to calibration to form mean 10B-7753 (5751±25 BP).

Groups 2, 5, 7, 8 and 12. The groups are dispersed across the northern portion of the subsite and so also enhance the overall spatial coverage of the radiocarbon dating.

Burial 7562 is from Group 2, and the grave contained an axe amongst its grave goods. Burial 6337 is from Group 5. It is a sparsely furnished grave that was selected because it cut burial 6338, for which no result was obtained. It produced two statistically consistent results (T'=0.0; T'(5%)=3.8; ν=1), which have been combined prior to calibration to form mean 10B-6337 (5727±23 BP). Burial 497 from Group 7 contained copper and *Dentalium* beads and the skeleton had signs of an infectious disease (perhaps tuberculosis). Burial 552 is from Group 8. The skeletal remains exhibited some kind of, not precisely definable, metabolic disease. Burial 362 is from Group 12, and the grave contained three pots, an axe and a flint blade. It has two statistically consistent results (T'=0.0; T'(5%)=3.8; ν=1), which have been combined prior to calibration to form mean 10B-362 (5854±25 BP).

Group 13. A total of 15 burials out of 38 graves were dated from this group. Of the 15 dated burials, four form two sequences, with the remaining ones not stratified in relation

to other dated features. This group formed part of an investigation into the prevalence of tuberculosis. The classic skeletal pathologies were found on an adult male skeleton's spine buried in grave 4027 (KÖHLER ET AL. 2013; 2014). Thirteen other individuals displayed severe atypical morphological lesions, of which six burials were dated (256, 398, 783, 813, 818 and 4011). Ancient DNA analysis to diagnose TB DNA in the skeletal material was performed on all individuals buried in this grave group, which confirmed the occurrence of TB in the case of four further individuals (PÓSA ET AL. 2015). All these have been dated (422, 791, 811 and 4027).

Burial 4027 was of the four-post construction type and contained six pots, a polished stone adze and a flint blade, whereas burials 256, 422 and 783 were poorly furnished.

Both burials 792 (*fig. 4*) and 813 are of the four-post construction type and relatively abundantly furnished with five vessels, polished stone tools, shell ornaments and flint blades. This stands in contrast to burials 796 and 798, which were poorly furnished.

Burials 811 and 4011 were not in graves of the four-post type, but were also fairly well furnished, and between them contained a stone macehead, altarpiece, polished stone adze and flint blades.

The two sequences of burials show similar differences in grave type and assemblages. The lower graves in both cases are of four-post construction and are more abundantly furnished than those that cut them. Burial 853 is cut by burial 791, and burial 6438 is cut by burial 818.

Burial 398 was the only one dated that contained copper artefacts. In addition to copper beads, the grave also had a pot with a spiral decoration that is considered a late chronological marker (ZALAI-GAÁL 2007, 106–7). The grave is situated at the very edge of the group and at a higher level than most of the other graves.

Group 14. Group 14 contained approximately 70 burials, of which nine have been dated, including a sequence of two intercutting graves. There is a dense cluster of graves in the south-west portion of the group with many intercutting, and there is also the suggestion of one row of graves.

Many of the dated graves are relatively well furnished compared to other graves in this group, because the sampling strategy focused on graves with axes, which are generally accompanied by a range of other grave goods. Four of the graves (3715, 3735, 3742 and 3831) contained copper artefacts, including copper beads and finger rings, while a complement of bone and stone tools (including axes) could be found with burials 3715, 3735, 3831, 3918, 3956 and 4005. Burials 3758 and 3760 were poorly furnished. The one dated sequence in the group is burial 3742, a grave of four-post construction type, which cut burial 3760. There was also intercutting between burials 3760 and 3831, but the relationship was unclear in the field.

Group 15. Six burials were dated from the approximately 40 burials that make up the group, which is fairly compact. The dated burials are concentrated in its centre. Groups 14 and 15 are approximately 7 m from one another, but the orientations of the burials in each cluster was completely different, with the heads pointing east in the former group and west in the latter. There are no stratigraphic relationships between the dated burials (822, 827, 828, 847, 1008 and 3770). Burial 847 is in a grave of four-post construction and has a pot with an anthropomorphic decoration, while burial 827 has *Dentalium* beads and burial 3770 has copper beads. The remaining graves are relatively poorly furnished. There are two statistically consistent results from burial 3770 (T'=0.0; T'(5%)=3.8; ν=1), which have been combined prior to calibration to form mean 10B-3770 (5785±24 BP). Similarly, two statistically consistent results from burial 822 (T'=0.0; T'(5%)=3.8; ν=1), have also been combined prior to calibration to form mean 10B-822 (5807±27 BP).

Group 18. One grave from Group 18, also in the northern part of 10B, was dated as part of the pilot study to investigate the potential for a freshwater reservoir offset (10B-3472). The two results from the human skeleton and a wild boar mandible are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1). Since the measurements are not from the same organism, they have been combined after calibration using the Combine function in OxCal.

Groups 22, 23 and 26. Two burials were dated in Group 22. Burial 3089 was in a grave of a four-post construction with a food offering, five pots and *Spondylus* shell ornaments. Burial 3020 had a possible food offering and seven pots.

Two very abundantly furnished burials were dated from Group 23. The graves contained a man (3060) and woman (1473). 3060 (*fig. 20*) is the burial of a right-crouched adult male (aged 40–49 years) in a four-post grave pit. It contained six vessels, three different types of polished stone axe, a polished macehead and flint blades. In addition it also included a necklace composed of *Dentalium* and copper beads, a very rich assemblage of *Spondylus* ornaments and four animal remains (a large aurochs trophy, the proximal fragment of an aurochs scapula, a polished red deer antler and a fragment of carpometacarpus from a griffon vulture). This burial is considered the richest male burial from this time period in eastern-central Europe (ZALAI-GAÁL ET AL. 2011b).

The two results from the human skeleton and the aurochs skull with horncores in burial 3060 are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1). Since the measurements are not from the same sample, they have been combined after calibration using the Combine function in OxCal.

Burial 1473 (*fig. 21*) is the grave of a right-crouched adult female (aged 40–59 years), also laid in a pit with a four-post construction. Seven vessels, copper items, a very rich assemblage of shell ornaments (over 1000 shell items are present), animal bone, flint tools, a fragment of a clay altar and a piece of red ochre were placed next to the deceased as grave goods.

Two burials were also dated from Group 26. These form an intercutting sequence with burial 1814 cut by burial 1799, which contained a copper arm ring.

Ungrouped graves. Ten burials were dated that did not belong to any grave grouping. Of these, two burials (3461 and 3463) had Bronze Age results and have been excluded from the modelling. Another five burials (679, 691, 736, 2549, and 4279) that intercut with settlement pits were dated, which are described below.

Burial 2959 was in the southern part of subsite 10B, while burial 5196 was in its western arm. Both were selected because the skeletal remains exhibited signs of Diffuse Idiopathic Skeletal Hyperostosis (DISH), which is relatively common in modern populations, and is linked to age, diet, sedentary lifestyle and reduced physical activity.

Grave 3241 was thought to cut settlement pit 3144 at the time of submission, but further examination of the excavation records suggests that this relationship is not clear and so this stratigraphic sequence is not included in the model.

Settlement pits. The dated settlement features in subsite 10B are concentrated in its northern part, with the exception of Pit 2525, which is in the western arm. A total of 13 pits were dated within this series, and six of them had a burial that cut the top of the excavated fills.

Pit 77 is of medium size (8.5 m in diameter) and lies in the middle of the northern part of subsite 10B. From this pit there are results from two different layers, with 77-2 from the bottom of the pit being earlier than 77-3 which comes from the upper layer of the pit.

Pit 126 is relatively small (c. 3.5 m in diameter) and circular in shape. The pit fills contained an abundance of pottery, and produced a single result on an articulating animal bone group (SUERC-52808).

House 27 is a rebuild of House 26 (*fig. 9*), located in the middle of the northern part of subsite 10B, near Grave Group 13. There are two dated features from it. Feature 4282 is very large posthole in the southern end of the house that contained the articulating remains of a dog cranium. Feature 382 is the middle posthole of the central dividing wall, from which there are two statistically consistent results (T'=0.8; T'(5%)=3.8; ν=1) on a pig humerus with refitting unfused epiphysis, which have been combined prior to calibration to form mean 10B-382 (5781±17 BP). There was a human burial (4279) that cuts posthole 4282. This burial must be later than both samples associated with House 27.

Settlement pit 441 is a relatively large, irregularly shaped pit with a length of 9 m. It forms part of a complex of pits and includes pit 723 in the very northern section of subsite 10B. There are three results on two samples from different areas of the pit. The single result from 441/723 is on a complete dog skeleton, while the two results from 441 are on a refitting unfused dog cranium from the second layer of the pit. The two results are statistically consistent (T'=1.6; T'(5%)=3.8; ν=1) and have been combined prior to

calibration to form mean 10B-441_2414 (5882±24 BP). Burial 679 cuts the pit to the north, and the burial contained an axe, an adze, a copper finger-ring and beads.

A sample from a complete dog skeleton in pit 619 was dated. This pit was cut by pit 395 from which a sample from a pig left tibia with refitting unfused epiphysis was dated. The two features lie in the middle of the northern part of the subsite, near Houses 26 and 27.

Three intercutting pits and a burial were dated from the north-western part of the subsite, to the west of House 13 (*fig. 8*). The earlier pit (140) has three measurements on two samples. Two statistically consistent results (T'=0.1; T'(5%)=3.8; ν=1) from an articulated wild boar metatarsal (140-3) have been combined prior to calibration to form mean 10B-140-3 (5798±16 BP). There is also a single result from an articulating wild boar radius and ulna (140-2). Pit 140 was initially thought to have been cut by pit 476 from which an articulating red deer ulna was dated. However, further examination of the field records (plans and photographs) has raised some doubts as to the validity of this interpretation, and so no relationship has been modelled. Pit 349 definitely cuts both pits 140 and 476. There are two results from samples of articulating red deer and cattle bone. Pit 349 was cut by burial 691, which was poorly furnished.

There is another sequence of a burial (736) cutting a settlement pit (69). Pit 69 is relatively small with an approximate diameter of 5 m, and the dated animal bone comes from two successive layers of fill. Burial 736 lies to the northern edge of the pit and is unfurnished. Two statistically consistent results from the burial (T'=3.4; T'(5%)=3.8; ν=1) have been combined prior to calibration to form mean 10B-736 (5829±17 BP).

Pit 2525 is small (2.5 m in diameter) and lies in the western arm of 10B. It was cut to the north by burial 2549, which was sparsely furnished.

Pit 3144 is relatively small (5 m in diameter) and lies in the southern part of subsite 10B. From it, a cattle ulna which was found to articulate with the radius was dated.

A total of 12 radiocarbon dates from subsite 10B have posterior outlier probabilities of more than 10%: nine burials and three samples from settlement features. This is more

than would be expected in a dataset of this size where all the data are compatible with the model presented.

In order to interpret the results from the chronological model for activity in subsite 10B (*figs 18* and *19*), we need to examine each radiocarbon date that has been identified as an outlier in an attempt to judge why it may be so (i.e. whether it is a misfit, an outlier, or an offset; BAYLISS ET AL. this volume, p00).

Considering first the graves (*fig. 18*), five burials have posterior outlier probabilities between 20% and 60% (*SUERC-53314: 10B-4307,* O: 12/5; *OxA-28926: 10B-256,* O: 13/5; *OxA-28250: 10B-3735,* O: 13/5; *OxA-27482: 10B-827,* O: 20/5; and *SUERC-53324: 10B-2959,* O: 15/5). These probably represent statistical outliers that accurately date burials that actually fall into the concentrated horizon of burial in subsite 10B suggested by the modelling. Three burials have posterior outlier probabilities greater than 60% (*MAMS-20657: 10B-3241*, O: 89/5; *SUERC-53322: 10B-853*, O: 86/5; and *OxA-27486: 10B-398,* O: 62/5), however, and clearly represent misfits. Burials 3241 and 853 are clearly much earlier, dating to the generations around 4800 cal BC rather than those around 4700 cal BC. Grave 853 was richly furnished (*tab. 5*) and had a four-post structure which may still have been visible when Grave Group 13 formed in this area a century or so later. Burial 398 seems to have been a later interment in the space previously occupied by Grave Group 13, as suggested by the recovery of this burial at a higher level than most of the other graves, its different orientation (head facing east) and the presence of a pot with a spiral decoration thought to be late (ZALAI-GAÁL 2007, 106–7). The final outlier (10B-6337, O: 35/5) is marginal, and may either be a burial that is later than the main concentrated phase of burial in this area or an extreme statistical outlier.

This interpretation of the outliers is important since it suggests that perhaps 49 of the 53 dated burials in our sample (92%) do actually fall in the very concentrated period of burial suggested by our modelling. There are, however, two outliers that clearly represent earlier burials in this area (4%), and perhaps two more that represent much later burials (4%).

Considering next the settlement (*fig. 19*), three dated samples have posterior outlier probabilities greater than 10% (*MAMS-20658: 10B-4282,* O: 68/5, *10B-382,* O:14/5, and *SUERC-52797: 10B-619,* O: 34/5). Two of these derive from House 27, the outlier probabilities arising from the relative dating of these samples with burial 4279 suggested by stratigraphy. This stratigraphic relationship has been reviewed and appears to be secure. The isotopic values of burial 4279 do not suggest that this individual consumed an unusual amount of fish and so has a detectable freshwater reservoir effect (BAYLISS ET AL. this volume, *tab. 5*). Consequently, it seems that MAMS-20658 must be an extreme statistical outlier and the dating suggested by the model must stand. This leaves 10B-619 (SUERC-52797), which is again marginal, and could suggest an element of earlier occupation in this area, but it may simply be a statistical outlier.

A narrative of Lengyel settlement and burial

Subsite 5603

The overall burial activity dated in subsite 5603 began in *4815–4725 cal BC* (*95% probability*; *fig. 12*; *start: 5603 - Cemetery*), probably in *4790–4740 cal BC* (*68% probability*).

Burial in Grave Group 56 began in *4780–4710 cal BC* (*95% probability*; *fig. 12*; *start: Grave Group 56*), and probably in *4750–4715 cal BC* (*68% probability*). This activity ended in *4725–4665 cal BC* (*95% probability*; *fig. 12*; *end: Grave Group 56*), probably in *4720–4685 cal BC* (*68% probability*). This burial activity spanned *1–95 years* (*95% probability*; *fig. 22*; *Span Grave Group 56*), probably *1–60 years* (*68% probability*).

Burial in Grave Group 59 began in *4795–4670 cal BC* (*95% probability*; *fig. 12*; *start: Grave Group 59*), probably in *4760–4710 cal BC* (*68% probability*). This activity ended in *4665–4490 cal BC* (*95% probability*; *fig. 12*; *end: Grave Group 59*), probably in *4600–4510 cal BC* (*68% probability*). This burial activity spanned *35–275 years* (*95% probability*; *fig. 22*; *Span Grave Group 59*), probably *120–240 years* (*68% probability*).

The overall burial activity dated in subsite 5603 ended in *4530–4440 cal BC* (*95% probability*; *fig. 12*; *end: 5603 - Cemetery*), probably in *4515–4465 cal BC* (*68% probability*). The dated burial activity spans *215–355 years* (*95% probability*; *fig. 22*; *Span 5603 - Cemetery*), probably *240–315 years* (*68% probability*).

The settlement in subsite 5603, as dated through a selection of settlement pits, began in *4805–4625 cal BC* (*95% probability*; *fig. 13*; *start: 5603 - Settlement Pits*), probably in *4745–4665 cal BC* (*68% probability*). The dated settlement activity ended in *4520–4475* (*3% probability*; *fig. 13*; *end: 5603 - Settlement Pits*) or *4450–4185 cal BC* (*92% probability*), probably in *4345–4245 cal BC* (*68% probability*). This settlement activity spanned *175–580 years* (*95% probability*; *fig. 22; Span 5603 – Settlement Pits*), probably *335–490 years* (*68% probability*).

Subsite 11

The overall burial activity dated in subsite 11 began in *4820–4730 cal BC* (*95% probability*; *fig. 15*; *start: 11 - Cemetery*), probably in *4795–4745 cal BC* (*68% probability*).

Burial in Grave Group 61A began in *4800–4675 cal BC* (*95% probability*; *fig. 15*; *start: Grave Group 61A*), probably in *4765–4700 cal BC* (*68% probability*). This activity ended in *4705–4555 cal BC* (*95% probability*; *fig. 15*; *end: Grave Group 61A*), probably in *4685–4605 cal BC* (*68% probability*). This burial activity spanned *1–205 years* (*95% probability*; *fig. 23*; *Span Grave Group 61A*), probably *1–10 years* (*4% probability*) or *30–145 years* (*64% probability*).

Burial in Grave Group 68 began in *4785–4710 cal BC* (*95% probability*; *fig. 15*; *start: Grave Group 68*), probably in *4760–4720 cal BC* (*68% probability*). This activity ended in *4715–4605 cal BC* (*95% probability*; *fig. 15*; *end: Grave Group 68*), probably in *4695–4645 cal BC* (*68% probability*). This burial activity spanned *1–165 years* (*95% probability*; *fig. 23*; *Span Grave Group 68*), probably *35–115 years* (*68% probability*).

The overall burial activity dated in subsite 11 ended in *4635–4480 cal BC* (*95% probability*; *fig. 15*; *end: 11 - Cemetery*), probably in *4585–4515 cal BC* (*68% probability*). The dated burial activity spans *120–325 years* (*95% probability*; *fig. 23*; *Span 11 - Cemetery*), probably *175–270 years* (*68% probability*).

The settlement in subsite 11, as dated through a selection of settlement pits, began in *4780–4660 cal BC* (*95% probability*; *fig. 16*; *start: 11 - Settlement Pits*), probably in *4745–4690 cal BC* (*68% probability*). The dated settlement activity ended in *4680–4525 cal BC* (*95% probability*; *fig. 16*; *end: 11 - Settlement Pits*), probably either in *4670–4620 cal BC* (*37% probability*) or *4610–4565 cal BC* (*31% probability*). The dated settlement activity spans *1–*

225 years (*95% probability*; *fig. 23*; *Span 11 - Settlement Pits*), probably *35–175 years* (*68% probability*).

Subsite 10B

The concentrated period of burial activity dated in subsite 10B began in *4740–4685 cal BC* (*95% probability*; *fig. 18*; *start: 10B - Cemetery*), probably in *4715–4690 cal BC* (*68% probability*).

Burial in Grave Group 13 began in *4730–4685 cal BC* (*95% probability*; *fig. 18*; *start: Grave Group 13*), probably in *4705–4685 cal BC* (*68% probability*). This activity ended in *4705–4660 cal BC* (*95% probability*; *fig. 18*; *end: Grave Group 13*), probably in *4700–4680 cal BC* (*68% probability*). This burial activity spanned *1–60 years* (*95% probability*; *fig. 24*; *Span Grave Group 13*), probably *1–20 years* (*68% probability*).

Burial in Grave Group 14 began in *4725–4685 cal BC* (*95% probability*; *fig. 18*; *start: Grave Group 14*), probably in *4705–4685 cal BC* (*68% probability*). This activity ended in *4710–4670 cal BC* (*95% probability*; *fig. 18*; *end: Grave Group 14*), probably in *4700–4680 cal BC* (*68% probability*). This burial activity spanned *1–45 years* (*95% probability*; *fig. 24*; *Span Grave Group 14*), probably *1–15 years* (*68% probability*).

Burial in Grave Group 15 began in *4725–4680 cal BC* (*95% probability*; *fig. 18*; *start: Grave Group 15*), probably in *4705–4685 cal BC* (*68% probability*). This activity ended in *4705–4660 cal BC* (*95% probability*; *fig. 18*; *end: Grave Group 15*), probably in *4700–4675 cal BC* (*68% probability*). This burial activity spanned *1–50 years* (*95% probability*; *fig. 24*; *Span Grave Group 15*), probably *1–15 years* (*68% probability*).

The concentrated period of burial activity dated in subsite 10B ended in *4705–4640 cal BC* (*95% probability*; *fig. 18*; *end: 10B - Cemetery*), probably in *4695–4670 cal BC* (*68% probability*). The concentrated period of dated burial activity spans *1–95 years* (*95% probability*; *fig. 24*; *Span 10B - Cemetery*), probably *1–40 years* (*68% probability*). As described above, 92% of burials in this subsite date to this very short period.

The settlement in subsite 10B, as dated through a selection of settlement pits, began in *4735–4695 cal BC* (*95% probability*; *fig. 19*; *start: 10B - Settlement Pits*), probably in *4720–*

4700 cal BC (*68% probability*). The dated settlement activity ended in *4715–4680 cal BC* (*95% probability*; *fig. 19*; *end: 10B - Settlement Pits*), probably in *4710–4690 cal BC* (*68% probability*). This settlement activity spanned *1–45 years* (*95% probability*; *fig. 24*; *Span 10B - Settlement Pits*), probably *1–20 years* (*68% probability*).

The spatio-temporal development of the Lengyel settlement and burial at Alsónyék

The dates when Lengyel burial and settlement began and ended on the three subsites at Alsónyék are summarised in *fig. 25* and *table 6*. By comparing the posterior density estimates, it is possible to calculate the probable order of pairs of different events (*tab. 7*). For example, it is *99.2% probable* that the concentrated phase of burial on subsite 10B (*start: 10B - Cemetery*) began after burial on subsite 11 (*start: 11 - Cemetery*). It is also possible to calculate joint probabilities. For example, the probability that burial on subsite 10B (*start: 10B - Cemetery*) began after burial on both subsite 11 (*start: 11 - Cemetery*) and on subsite 5603 (*start: 5603 - Cemetery*) is 99.2% × 98.8% = 98.0%. It is not possible to determine whether burial on the site began first on subsite 11 or first on subsite 5603 (*58.6% probable* versus *41.4% probable*), but the first burials probably appeared in the southern part of the Lengyel site in the first half of the 48th century cal BC with burial intensifying across the northern part of the site two or three generations later (*fig. 25*).

In contrast Lengyel settlement appears to have appeared everywhere across the site in the decades around 4700 cal BC (*fig. 25*). It is not possible to determine the relative order of its beginning on the different subsites (*tab. 7*). The medians of the posterior density estimates for the start of settlement on the different subsites vary by less than a decade.

Overall it is *97.5% probable* that Lengyel burial began on the site before the settlement was established. The concentration and expansion of burial into the northern area appear to be contemporary with the foundation of the settlement across the whole 80 ha area of the Lengyel site (*fig. 25*). The medians of the posterior density estimates for the start of settlement on the different subsites vary from the start of the concentrated horizon of burial on subsite 10B by less than 15 years.

Lengyel burial ended at different times across the site (*fig. 25; tab. 6*). First, in the early 47th century cal BC, the concentrated horizon of burial ended on subsite 10B. Then, sometime in the 46th century cal BC, burial ended on subsite 11. It persisted longest on

subsite 5603, where it probably ended in the first half of the 45th century cal BC. This order of endings in the different areas is *94.9% probable*.

Lengyel settlement also ended at different times across the site (*fig. 25; tab. 6*), following the same sequence (*99.8% probable*). First, in the decades around 4700 cal BC, came the end of the brief episode of settlement on subsite 10B. Then, at a time that is imprecisely known somewhere within the later 47th or earlier 46th century cal BC, settlement ended on subsite 11. It endured on subsite 5603, where it probably ended in the later 44th century cal BC.

On subsite 10B it is *94.5% probable* that the settlement activity ended before the concentrated horizon of burial and, similarly, on subsite 11 the settlement appears to have been abandoned before burial ended (*82.7% probable*). On subsite 10B the intense period of burial outlasted the settlement by a couple of decades or so, but on subsite 11 burial endured for a few generations. On subsite 5603, however, the settlement clearly outlasted burial (*100% probable*), for a period of *−25–305 years* (*95% probability*; distribution not shown; difference *end: 5603 - Cemetery / end: 5603 - Settlement Pits*), probably for a period of *125–250 years* (*68% probable*).

These varied beginnings and endings mean that the duration of Lengyel burial and settlement in different areas of the site also vary (*fig. 26; tab. 8*). The occupation on subsite 10B was intense, but brief, with neither settlement nor the intense period of burial enduring for more than a decade or two. The duration of the settlement on subsite 11 is imprecisely known, but probably endured for several generations, but burial in this area clearly continued for a couple of centuries. Activity endured longest on subsite 5603, where burial continued for approaching 300 years and the settlement was occupied for around four centuries.

Grave groups

It is currently difficult to make any precise distinctions between the groups based on the grave goods, because many of the finds are under restoration and so cannot yet be fully studied. Nonetheless two main categories of grave group can be defined on the basis of size; smaller grave groups (25–40 burials) and larger ones (ca. 100 burials) are both spread across the whole site. Further distinctions in their use should be possible after a

full evaluation of the finds. But it already seems clear that the four-post graves in subsite 11 are less numerous as well as less well furnished than those in the northern part of subsite 10B. This means fewer copper (such as arm rings) and shell artefacts (*Spondylus* and *Dentalium*), and no lavish individuals (such as burial 3060 and 1473).

A total of seven grave groups across the three subsites were so intensively dated that it was necessary to apply a uniform prior probability to their distribution, thus reducing the weight of this very localised activity on the overall model results. In practice, the 8–19 individual parameters that make up each of these grave groups is reduced to two, which represent the 'start' and 'end' date of the burial activity within the group (*fig. 27*). One benefit is that the probabilities derived from the dating allow us to explore intra-site variability in burial over time with specific reference to coherent spatial groupings.

In subsite 5603, Grave Groups 56 and 59 were intensively dated. Group 56 is a compact group with what appear to be rows of graves. The group is sited immediately south of House 100, apparently closely conforming to the width of the short end of the structure. The modelling suggests that the formal organisation of this group was intentional, estimating that burials in Grave Group 56 occurred over a period of *1–95 years* (*95% probability*; *fig. 28*; *span: Grave Group 56*), probably *1–60 years* (*68% probability*). Grave Group 56 was in use during the second half of the 48th century cal BC (*fig. 27*). Group 59, in the middle of the eastern arm of subsite 5603, is a very large grave group with 100 burials. The north-western part is considerably more compact, with burials becoming more dispersed moving toward the south-east. While in some instances a handful of graves may form rows, the overall impression in this group is that the inhumations occurred over a period of time. Group 59 formed between the later 48th century cal BC and the 46th century cal BC (*fig. 27*). It formed over the longest timespan of all the dated groups of burials, over a protracted period of *35–275 years* (*95% probability*; *fig. 28*; *span: Grave Group 59*), probably *120–240 years* (*68% probability*). This is consistent with it being one of the largest grave groups.

Grave Groups 61A and 68 were dated in subsite 11. Both are situated in the extreme southern portion of the subsite (and probably continue beyond it). The two groups begin being used at about the same time, and contain ca. 80 and 45 inhumations, respectively. Graves in Group 61 appeared to form rows, and the 61A part shows a high density

where the grave pits touch each other. Group 68 has a much looser structure, and covers roughly the same area as Group 61, but has only half as many burials. Both groups appear to have been used for two or three generations between the mid-to-late 48th century cal BC and the early-to-mid 47th century cal BC (*figs 27* and *28*).

Within subsite 10B, the three well dated grave groups (13, 14 and 15) have very similar chronologies, due in large part to the very short period of intensive activity that occurred here, with each group used for little more than a decade (*fig. 28*). While the three groups are located in close proximity to one another, it is potentially highly significant that they do not display the same characteristics. Groups 13 and 15 have a similar character in terms of size and number of burials included. Group 14 is twice as large and contained ca. 70 burials. Individuals buried in Group 13 and 15 were placed with their heads facing west and those in Group 14, starting ca. 4.5 m to the west, were placed with their heads facing east.

At least 18 of the 38 burials in Grave Group 13 showed evidence of tuberculosis (PÓSA ET AL. 2015). This outbreak has now been dated to between *4730–4685 cal BC* (*95% probability*; *fig. 27*; *start: Grave Group 13*), probably *4705−4685 cal BC* (*68% probability*), and *4705−4660 cal BC* (*95% probability*; *fig. 27*; *end: Grave Group 13*), probably *4700−4680 cal BC* (*68% probability*). One other dated skeleton shows signs of disease, burial 10B-497, which dates to *4710−4655 cal BC* (*95% probability*; *fig. 18*; OxA-*27465: 10B-497*), probably to *4700−4675 cal BC* (*68% probability*).

This dating is compatible with there having been an epidemic of tuberculosis in the settlement when it was at its largest extent. Potentially this could be a reason why the occupation of subsite 10B was so brief and the settlement contracted so quickly, though it will be important in due course to check for the presence of the disease in other grave groups.

Copper arm rings

One of the initial predictions was that there might be some chronological sensitivity to the burial of individuals with heavy copper arm rings. These were encountered much less frequently than ornaments made of copper beads and shell. The modelled probability densities were extracted from the three subsite models and are given in *fig. 29*. While the

sample is relatively small (six graves with arm rings), neither the very earliest nor the very latest burials at Alsónyék are represented. Heavy copper arm rings are certainly present, however, from the first quarter of the 47th century cal BC.

Axes

One aim the radiocarbon dating programme was to provide a chronology for a nascent seriation of stone axeheads recovered from graves. Although the seriation was never completed, a formal typology consisting of six types was produced (ZALAI-GAÁL ET AL. 2014a). Twenty-two dated graves contain stone axeheads that have been assigned to one of these types (*fig. 30*). These come from subsites 5603 and 10B and derive from ten different grave groups. No grave group contains more than two dated graves with classified axeheads, except for grave group 14 on subsite 10B which contains six such graves (containing axeheads of types B, D, E, and F). Another 12 graves contain axeheads that are either not diagnostic or have yet to be classified. All the axehead types appear to have been in use during the time when the site was used most intensively, in the generations around 4700 cal BC. No clear chronological trends are apparent but, on the basis of the samples of graves currently dated, not all axehead types may have been in use before 4700 cal BC (e.g. A–D) and not all necessarily continued in use beyond 4600 cal BC (e.g. A and F). These apparent trends may be an artefact of the available sample and further dated examples are required to confirm these suggestions.

Chronological summary

It is clear that Alsónyék presents an unrivalled opportunity to examine burial and settlement together in a Lengyel context. There is a wealth of new insights about both dimensions of the site. It is apparent that Alsónyék did not belong to an early phase of Lengyel culture development. Our modelling has established the timings, durations and relationships between burial and settlement activity in the three Alsónyék subsites investigated (*figs 25–26*). The first burials appear to have begun in the earlier 48th century cal BC in subsites 5603 and 11. The end of burial activity in these areas was to fall at the very start of the 45th century cal BC and during the 46th century cal BC respectively. Burial in subsite 10B, however, appears to have been concentrated in the decades around 4700 cal BC, probably over the span of a single generation. The settlement appears to have been established swiftly on all subsites at the time when the concentrated period of burial in subsite 10B began. Settlement activity ended before burial on both subsites 10B

and 11, but appears to have continued for much longer in subsite 5603, until the end of the 44th century cal BC. The peak of both burial and settlement activity probably lay either side of 4700 cal BC.

Examining the reliability of the Lengyel chronology

Three alternative models were constructed for Lengyel activity on each of the subsites at Alsónyék. Key parameters for the start and end of burial and settlement on each subsite from each of the models are shown on *fig. 31*.

First, the model for each subsite was run without the general outlier analysis. The model for subsite 5603 has good overall agreement (Amodel: 71) and produces date estimates for the start and end of burial and settlement in this area that are almost identical to those provided by the preferred model shown in *figs 12* and *13* (the medians of the equivalent parameters vary by a maximum of three years). The model for subsite 11 also has good overall agreement (Amodel: 73) and again produces date estimates for the start and end of burial and settlement in this area that are almost identical to those provided by the preferred model shown in *figs 15* and *16* (the medians of the equivalent parameters vary by a maximum of 12 years). We have excluded the earliest and latest graves from this model of subsite 10B, since the preferred model has shown these burials to be clear outliers from the main period of burial in this area (SUERC-53322 and mean of results from 10B-398), but the model for subsite 10B has poor overall agreement nonetheless (Amodel: 47). The date estimates for the settlement activity in this area are almost identical to those provided by the preferred model shown in *fig. 19* (the medians of the equivalent parameters vary by a maximum of four years), but the dates estimates for the use of the cemetery differ appreciably, with the start being about a generation earlier than in the preferred model and the end about a generation later (the medians of the equivalent parameters vary by 26 and 19 years respectively). These differences again appear to arise from the presence of a small number of graves in this area which pre-date and post-date its main period of concentrated use. All five burials with individual indices of agreement below 25 in this model were also identified outliers by the previous analysis (see above, MAMS-20657, A: 16; the mean of results from 10B-6337, A: 22; OxA-27482, A: 23, OxA-28250, A: 24; and OxA-28926, A: 29).

Second, the general outlier models were run using trapezium boundaries (KARLSBERG 2006; LEE / BRONK RAMSEY 2012) for the cemetery and settlement models for each subsite, allowing for a more gradual introduction and exit of the dated cultural phase. For example the period of introduction of burial on subsite 5603 is estimated to have first begun in *4845–4730 cal BC* (*95% probability*; *5603: Cemetery start start*; *fig. 31*), probably in *4805–4745 cal BC* (*68% probability*), and its introduction is estimated to have been complete by *4810–4720 cal BC* (*95% probability*; *5603: Cemetery end start*; *fig. 31*), probably by *4780–4735 cal BC* (*68% probability*), taking *1–70 years* (*95% probability*; distribution not shown), probably *1–25 years* (*68% probability*). Although the two models do not produce directly equivalent parameters, it is clear that the introduction of burial in this area was swift (and so the point estimate for the introduction of burial on subsite 5603 provided by the preferred model is not importantly wrong) and that both models estimate this to have occurred in the first half of the 48th century cal BC. Similarly, the end burial in subsite 5603 seems to have been swift and both models agree in placing this ending in the first decades of the 45th century cal BC. The introduction and demise of settlement in subsite 5603 appears to have been much slower, with the decline of the settlement in particular probably occurring over a century or two (*fig. 31*). The preferred and trapezium models agree, however, in placing the start of the settlement ca. 4700 cal BC and final ending at the start of the 43rd century cal BC. On subsite 11 the phase of burial began and ended swiftly, and again the preferred and trapezium models agree in the dating of these boundaries. The phase of settlement also began and ended swiftly, the two models produce very similar date estimates (*fig. 31*). On subsite 10B both burial and settlements also began and ended very swiftly, and the preferred and trapezium models provide date estimates that are almost identical.

Third, the general outlier models were run using mixed-source calibration for samples from human and dog skeletons in order to explore the effect of any potential freshwater reservoir offset (see BAYLISS ET AL. this volume, 00). The model for subsite 5603 produces date estimates for the start and end of burial and settlement in this area that are very similar to those provided by the preferred model shown in *figs 12* and *13* (the medians of the equivalent parameters vary by a maximum of 14 years). The model for subsite 11 similarly produces date estimates for the start and end of burial and settlement in this area that are very similar to those provided by the preferred model shown in *figs 15* and *16* (the medians of the equivalent parameters vary by a maximum of ** years).

The freshwater reservoir model for subsite 10B produces date estimates for the start of burial and for settlement in this area that are very similar to those provided by the preferred model shown in *figs 18* and *19* (the medians of the equivalent parameters vary by a maximum of seven years). The date estimate for the end of the cemetery, however, is a decade or two later in this reading (the medians of these parameters vary by 17 years). This reflects the possibility that a small amount of freshwater fish was consumed by some of the dated individuals.

The alternative models constructed for the Lengyel occupation at Alsónyék generally produced results that are remarkably similar to those presented in the preferred models (*fig. 31)*. Date estimates for burial on subsite 10B are most sensitive. It is clear that a small number of burials were placed in this area both before and after the concentrated phase of burial here in the generations around 4700 cal BC. It is also possible, however, that this concentrated phase of burial continued for a decade or two later than suggested by the preferred model. The trapezium models confirm that the appearance and demise of burial and settlement in different areas of the site were swift, with the exception of settlement on subsite 5603 which appears to have declined gradually over the course of several centuries.

Initial discussion

In the final paper that follows, *The Alsónyék story: towards the history of a persistent place*, the many wider implications of the trajectory presented above are followed in much more detail, and in conjunction with the earlier phases of the site. Big issues of village development, persistent place, sense of place and imagined community, aggregation and coalescence, population density and internal difference will all be discussed there. Here it is sufficient first to underline the very distinctive history of the Lengyel occupation of Alsónyék, and secondly to draw initial attention to some of the specific questions which it immediately raises.

Two features are of particular interest, both in themselves and in relation to the local and regional context within south-east Transdanubia: the appearance at Alsónyék of burials before settlement activity, and then the surge in settlement activity accompanying a further intensification of burial, in a short period of time either side of 4700 cal BC. This invites comparison with other Lengyel sites locally and regionally, but exposes the

limitations of current knowledge. Is Alsónyék the exception, not just in terms of its maximum size, but also in its combination of intense burial activity and settlement? There are several uncertainties to take into account. Alsónyék has been excavated on a far greater scale than most other comparable sites in south-east Transdanubia and beyond. Whether it is really larger than its not distant neighbours such as Mórágy-Tűzkődomb, about 6 km away, and Zengővárkony and the site of Lengyel itself, both not much more than 20 km afield, is perhaps an open question, though the extensive trial trenching at Zengővárkony (DOMBAY 1960) may suggest a size of 40 ha, of a significantly lesser order of magnitude to Alsónyék. Nor is it yet certain whether these are directly contemporary or at least partially overlap in time within the Lengyel culture of the region (ZALAI-GAÁL ET AL. 2014a; 2014b). It is a further aim of the ToTL project to provide formal date estimates for the phases of the Lengyel culture in Transdanubia and beyond with greater precision, exploiting the seriated ceramic sequence (ZALAI-GAÁL ET AL. 2014b, Abb. 43), and that work is in progress. Some traces of settlement are known from Zengővárkony (DOMBAY 1960), but few seem apparent from the more recent excavations at Mórágy-Tűzkődomb (ZALAI-GAÁL 2001a; 2002). It becomes a pressing question for future research whether on the one hand all three sites followed roughly the same kind of sequence, but with our knowledge of the settlement dimension at Zengővárkony and Mórágy reduced because of the circumstances of the investigations, or on the other if it was at Alsónyék alone that, if only for a brief initial phase, houses were built in numbers. If the latter, Alsónyék then stands out doubly, for the great numbers of burials and the vast extent of houses and pits. The following paper looks at the possible scenarios which might have produced such a concentration of people and activity.

In the resulting aggregation, there are already some signs of potentially significant variation and differentiation, though there is much more post-excavation work still to be done to evaluate all the finds and contexts, and any interpretation is unavoidably provisional at this stage. Finds with four-post construction graves in the northern part of subsite 10B are more abundant compared to subsite 11; there are subtle variations in Grave Groups 61 and 61A, with rows beginning to form in some places but not others; and there were varying durations among Grave Groups 56–59 and 61–68 (*fig. 28)*. The two most richly furnished graves both come from Grave Group 23 on subsite 10B. These graves contained a man (3060: *fig. 20*; ZALAI-GAÁL ET AL. 2011B) and a woman

(1473: *fig. 21*; ZALAI-GAÁL ET AL. 2010, 314–15, 319, Abb. 12a–b). The body in the male grave was accompanied by a large aurochs trophy, a large set of polished stone axes, the largest stone knife ever found in the Carpathian Basin, *Spondylus* and *Dentalium* ornaments, and copper beads. The woman in grave 1473 has comparably abundant grave goods, especially of *Spondylus* and *Dentalium*. These individuals were probably buried in the early decades of the 47th century cal BC, as were the people buried in the adjacent Grave Groups 13, 14 and 15 on subsite 10B. These are not identical in terms of the grave orientations and body position, and so this diversity is surely significant amongst a group of people who would have known each other. Though the sample is tiny, the apparent concentration of dated stone axes around 4700 cal BC (*fig. 30*) could also speak to the importance of display among peer groups at the peak of the occupation aggregation. Directly contemporary groups were signalling difference in mortuary practice, and while there is again much more work to be done, this may encourage the view that such a rapid and large concentration of people would only have been possible if previously separate communities had been brought together, for any number of possible reasons. On this basis, the paper that follows explores the potentially significant theme of coalescence.

Anticipating the discussion that follows in the next paper, we know on comparative grounds that many early villages of any size were, other things being equal, socially fragile, and subject to any number of internal tensions, which regularly led to their fairly rapid demise. This might apply also in the case of Alsónyék, but the strikingly rapid surge and very brief flourishing of the peak of simultaneous burial and settlement activity can also suggest very specific causes, rather than simply the operation of recurrent processes in similar conditions. This applies to both the coming together and the breaking up of the major aggregation across Alsónyék. Disease has been mooted as a factor in the abandonment of subsite 10B, and it might also perhaps be appropriate to consider its role in encouraging people to come together, escaping bad conditions elsewhere. But the fact that burial preceded settlement at Alsónyék may rather suggest that in some way it was either the renown of the place that drew people in numbers around 4700 cal BC or that bad conditions in the region drove people to seek a prominent place as a resort in times of trouble. The following paper looks at a range of conditions, including the threat of conflict and violence, which elsewhere push people together.

The modelled estimates given above also make it clear that the Alsónyék story did not have a quick ending. Whatever caused the peak of aggregation to pass did not lead to the abandonment of the site as a whole, and what remained was probably still of considerable size. The place may now have had dual significance, first for continuing burial, which outlasted settlement on subsites 10B and 11, but also for residence, that continuing longest on subsite 5603. It will again be for further evaluation to tease out potential differences in the character of later burial and settlement, compared to both the phase of maximum aggregation around 4700 cal BC and in the beginnings of burial activity in the 48th century cal BC, and for future regional research to compare late Alsónyék with other contemporary sites.

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Summary · Zusammenfassung · Résumé

SUMMARY The Neolithic settlement of Alsónyék reached its greatest extent during the Late Neolithic Lengyel period. Nearly 9000 features, including postholes associated with 123 houses, pits and pit complexes, and ca. 2300 burials, could be assigned to it. The traces of Lengyel settlement and burials were found over the entire excavated area, with an estimated extent of some 80 ha.

The burials uncovered mostly form part of groups of graves, actually being small cemeteries within the various parts of the settlement. Apart from the grave groups, several solitary or scattered graves were also found. Other large Lengyel burial grounds

or large Lengyel settlements with numerous burials are known in Transdanubia, but the enormous number of graves at Alsónyék is unprecedented within the Lengyel cultural complex as a whole and provides exciting opportunities for varied archaeological and bioarchaeological investigations.

The discovery of 122 surface-level, timber-framed houses at a single site is also unique for the area and the Lengyel period as a whole. These buildings help to build a better understanding of the architecture and lifestyle of the Lengyel population, which is a fairly new strand in the settlement archaeology of the Lengyel culture in Hungary and beyond. This and the sheer size of the site make Alsónyék exceptionally significant.

Altogether 216 radiocarbon results are presented for the Lengyel phase. For the purpose of analysis subsites 5603, 11 and 10B have been modelled separately. The modelled estimates are precise enough that it is possible to estimate robustly the timing of activity across the site. The modelling suggests that burial activity in subsite 5603 probably began in *4790–4740 cal BC* (*68% probability*) and that it began at a similar time, *4795–4745 cal BC* (*68% probability*), in subsite 11. An intensive period of burial began slightly later, in *4715–4690 cal BC (68% probability)*, on subsite 10B. At this time settlement was established across a wide area, in subsite 11 from *4745–4690 cal BC (68% probability)*, on subsite 5603 from *4745–4665 cal BC (68% probability)*, and on subsite 10B from *4720–4700 cal BC (68% probability)*.

After a brief episode of intense occupation, lasting at most a few decades, settlement and then burial ended on the northernmost subsite 10B, in the *4700s or 4690s cal BC (68% probability)* and *4695–4670 cal BC (68% probability)* respectively. Settlement also ended before burial on subsite 11, but endured for much longer. The settlement here ended in *4670–4620 cal BC (37% probability)* or *4610–4565 cal BC (31% probability)* and burial in *4585–4515 cal BC (68% probability)*. Both settlement and burial endured longest on subsite 5603, although here the end of burial preceded the end of settlement by well over a century. Burial ended here in *4515–4465 cal BC (68% probability)*, and settlement ended in *4345–4245 cal BC (68% probability)*.

ZUSAMMENFASSUNG

RÉSUMÉ

Bibliography

ANTONI 1982
J. ANTONI, Régészeti kutatások a Dunántúlon. Őskori elődeink Csabdiban. A Komárom Megyei Múzeumok és a Fejér Megyei Múzeumok Régészeti kiállításai I (Tata 1982).

BÁNFFY 1995a
E. BÁNFFY, Early Chalcolithic settlement at Zalaszentbalázs-Szőlőhegyi mező. Antaeus 22, 1995, 71–108.

BÁNFFY 1995b
ID., Neolithic and Copper age settlements at Hahót and Zalaszentbalázs (Zalaszentbalázs-Pusztatető, Hahót-Szartóri I–II). Antaeus 22, 1995, 35–50.

BÁNFFY ET AL. 2010
E. BÁNFFY / T. MARTON / A. OSZTÁS, Early Neolithic settlement and burials at Alsónyék-Bátaszék. In: J.K. Kozłowski / P. Raczky (eds), Neolithisation of the Carpathian Basin: northernmost distribution of the Starcevo/Körös culture (Kraków–Budapest 2010) 37–51.

BÁNFFY ET AL. this volume
E. BÁNFFY / A. OSZTÁS / K. OROSS/ I. ZALAI-GAÁL / T. MARTON / É.Á. NYERGES / K. KÖHLER / A. BAYLISS / D. HAMILTON / A. WHITTLE, The Alsónyék story: towards the history of a persistent place.

BARNA 1996
J.P. BARNA, A lengyeli kultúra tömegsírja Esztergályhorvátiban. The common grave of the Lengyel Culture in Esztergályhorváti (County Zala). Zalai Múzeum 6, 1996, 149–60.

BARNA 2007
ID., A new site of the Lengyel Culture in Sormás-Török-földek (County Zala, south-western Transdanubia). In: J.K. Kozłowski / P. Raczky (eds), The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in Central Europe (Kraków 2007) 365–80.

BARNA 2011
ID., Adatok a dunántúli késő neolitikus háztípusokhoz. A Sopot- és a korai lengyeli kultúra házai Sormás–Török-földek lelohelyen. Beiträge zu spätneolithischen Haustypen in Transdanubien. Häuser der Sopot und der frühen Lengyel-Kultur am Fundort Sormás–Török-földek. Móra Ferenc Múzeum Évkönyve — Studia Archaeologica 12, 2011, 31–45.

BARNA ET AL. 2015
J.P. BARNA / M.Z. TOKAI / I. EKE / E. PÁSZTOR, A késő neolitikus körárkok kutatásának helyzete Zala megyében. Current research on late neolithic rondels in Zala County. Archeometriai Műhely 2015/XII./2, 75–88.

BARTA ET AL. 2013
P. BARTA / P. DEMJÁN / K. HLADÍKOVÁ / P. KMEŤOVÁ OVÁ / K. PIATNIČKOVÁ, Database of radiocarbon dates measured on archaeological samples from Slovakia, Czechia, and adjacent regions. Archaeological Chronometry in Slovakia, Slovak Research and Development Agency Project No. APVV-0598-10, 2011–2014, Dept. of Archaeology, Faculty of Arts, Comenius University in Bratislava. URL: http://www.c14.sk

BAYLISS ET AL. this volume
A. BAYLISS / N. BEAVAN / D. HAMILTON / K. KÖHLER / É.Á. NYERGES / C. BRONK RAMSEY / E. DUNBAR / M. FECHER / T. GOSLAR / B. KROMER / P. REIMER / K. OROSS / A. OSZTÁS / A. WHITTLE, Peopling the past: creating a site biography in the Hungarian Neolithic.

BERTÓK ET AL. 2008
G. BERTÓK / CS. GÁTI / O. VAJDA, Előzetes jelentés a Szemely-Hegyes lelőhelyen (Baranya megye) található neolitikus körárok-rendszer kutatásáról (Preliminary report on the research at the neolithic Kreisgrabenanlage at Szemely-Hegyes, Baranya county, Hungary). Archaeologiai Értesítő 133, 2008, 85–106.

BERTÓK / GÁTI 2011
G. BERTÓK / CS. GÁTI, Neue Angaben zur spätneolithischen Siedlungsstruktur in Südosttransdanubien. Acta Archaeologica Academiae Scientiarum Hungaricae 62, 2011, 1–28.

BERTÓK / GÁTI 2014
ID., Régi idők — új módszerek. Roncsolásmentes régészet Baranya megyében 2005–2013. (Budapest / Pécs 2014).

BICKLE / WHITTLE 2013
P. BICKLE / A. WHITTLE, LBK lifeways: a search for difference. In P. Bickle / A. Whittle (eds), The first farmers of central Europe: diversity in LBK lifeways (Oxford 2013) 1–27.

BISTÁKOVÁ / PAŽINOVÁ 2010
A. BISTÁKOVÁ / N. PAŽINOVÁ, (Un)Usual Neolithic and Early Eneolithic mortuary practices in the area of the North Carpathian Basin. Documenta Praehistorica 37, 2010, 147–59.

BÖKÖNYI 1959
S. BÖKÖNYI, Die Frühalluviale Wirbeltierfauna Ungarns (vom Neolithikum bis zur La Tène Zeit). Acta Archaeologica Academiae Scientiarum Hungaricae 11, 1959, 39–102.

BÖKÖNYI 1960
ID., A lengyeli kultúra gerinces faunája I. (Die Vertebratenfauna der Fundorte der Lengyeler Kultur I). Janus Pannonius Múzeum Évkönyve 1960 (1961), 85–133.

BÖKÖNYI 1961
ID., A lengyeli kultúra gerinces faunája II. (Die Vertebratenfauna der Fundorte der Lengyel Kultur II). Janus Pannonius Múzeum Évkönyve 1961 (1962), 91–103.

BÖKÖNYI 1962

ID., A lengyeli kultúra gerinces faunája III. (Die Wirbeltierfauna der Fundorte der Lengyeler Kultur III). Janus Pannonius Múzeum Évkönyve 1962 (1963), 73–101.

BRONK RAMSEY 1995
C. BRONK RAMSEY, Radiocarbon calibration and analysis of stratigraphy: the OxCal program. Radiocarbon, 37, 1995, 425–30.

BRONK RAMSEY ET AL. 1999
C. BRONK RAMSEY / P.B. PETTITT / R.E.M. HEDGES / G.W.L. HODGKINS, Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 27. Archaeometry 41, 1999, 197–206.

BRONK RAMSEY 2009
C. BRONK RAMSEY, Dealing with outliers and offsets in radiocarbon dating. Radiocarbon 51, 2009, 1023–45.

BUCK ET AL. 1996
C.E. BUCK / W.G. CAVANAGH / C.D. LITTON, Bayesian approach to interpreting archaeological data (Chichester 1996).

ČIŽMÁŘ ET AL. 2008
Z. ČIŽMÁŘ / P. KALÁBKOVÁ / E. KAZDOVÁ / J. KOVÁRNÍK, Lid s moravskou malovanou keramikou lengyelské kultury. Das Volk mit mährischer bemalter Keramik der Lengyelkultur. The people with Moravian Painted Pottery of the Lengyel culture. In: Z. Čižmář (ed.), Život a smrt v mladší době kamenné — Leben und Tod in der Jungsteinzeit — Life and death in the New Stone Age (Znojmo 2008) 76–87.

DEMJÁN 2012
ID., Grave typology and chronology of a Lengyel culture settlement: formalized methods in archaeological data processing. In: J. Kolář / F. Trampota (eds), Theoretical and methodological considerations in Central European Neolithic archaeology (Oxford 2012) 77–93.

DOMBAY 1939
J. DOMBAY, A zengővárkonyi őskori telep és temető. The prehistoric settlement and cemetery at Zengővárkony (Budapest 1939).

DOMBAY 1958
ID., Kőrézkori és kora vas-kori település nyomai a pécsváradi Aranyhegyen. Überreste einer Aeneolithischen und Früheisenzeitlichen Ansiedlung an Berg Arany (Goldberg) bei Pécsvárad. Janus Pannonius Múzeum Évkönyve 3, 1958, 53–102.

DOMBAY 1959
ID., Próbaásatás a villánykövesdi kőrézkori lakótelepen. Probegrabung an der aeneolithischen Ansiedlung bei Villánykövesd. (Kom. Baranya). Janus Pannonius Múzeum Évkönyve 4, 1959, 55–71.

DOMBAY 1960
ID., Die Siedlung und das Gräberfeld in Zengővárkony (Budapest / Bonn 1960).

EGRY 2001

EGRY M.I., Beszámoló a Győr–Marcalváros-Bevásárlóközpont területén végzett megelőző régészeti feltárásokról. Report on the preliminary exploration carried out on the area of Győr–Marcalváros-Shopping Centre. Arrabona 39/1–2, 2001, 57–78.

EGRY 2003
ID., Rézkori településrészlet Mosonszentmiklós-Egyéni földek lelőhelyen. Das Detail einer kupferzeitlichen Siedlung auf dem Fundort Mosonszentmiklós-Egyéni földek. Móra Ferenc Múzeum Évkönyve – Studia Archaeologica 9, 2003, 95–100.

FIGLER ET AL. 1997
A. FIGLER / L. BARTOSIEWICZ / GY. FÜLEKY / E. HERTELENDI, Copper Age settlement and the Danube water system: a case study from north western Hungary. In: J. Chapman / P. Dolukhanov (eds), Landscapes in flux: central and eastern Europe in antiquity (Oxford 1997) 209–30.

GALLINA ET AL. 2010
ZS. GALLINA / P. HORNOK / T. PALUCH / K. SOMOGYI, Előzetes jelentés az M6 AP TO 10/B és 11. számú lelőhelyrészen végzett megelőző feltárásról. Alsónyék-Bátaszék (Tolna megye) 2006–2009 (Vorbericht über die präventive Ausgrabung am Fundortsteil Nr. M6 AP TO 10/B und 11. Alsónyék-Bátaszék (Komitat Tolna) 2006–2009). Wosinsky Mór Múzeum Évkönyve 32, 2010, 7–100.

ILON 2004
G. ILON, Szombathely őskori településtörténetének vázlata (Outline of the Pre-historic Settlement of Szombathely). Őskorunk 2. Szombathely (Szombathely 2004).

ILON / FARKAS 2001
G. ILON / CS. FARKAS, Houses of the late-Lengyel settlement at the boundary of Szombathely (county Vas, Western Hungary). In: J. Regenye (ed.), Sites and stones: Lengyel culture in western Hungary and beyond. A review of the current research (Veszprém 2001) 55–60.

HERTELENDI 1995
E. HERTELENDI, 14carbon dating of Zalaszentbalázs–Szőlőhegyi mező 1992-1993. Antaeus 22, 1995, 105–7.

KALÁBEK ET AL. 2010
M. KALÁBEK / P. KALÁBKOVÁ / J. PEŠKA, A settlement burial in Hulín-Pravčice and its contribution to absolute dating of the Lengyel culture. In: J. Šuteková / P. Pavúk / P. Kalábková / B. Kovár (eds), PANTA RHEI: studies on the chronology and cultural development of south-eastern and central Europe in earlier prehistory presented to Juraj Pavuk on the occasion of his 75th birthday (Bratislava 2010) 255–62.

KALICZ 1974
ID., Neue Forschungen bezüglich der Lengyelkultur in Ungarn. Sborník Prací Filozoficke Fakulty Brnenské Univerzity Studia Minora Facultatis Philosophicae Universitatis Brunensis. E 20-21, 1974 (1975-1976), 51–61.

KALICZ 1977
ID., Früh- und spätneolithische Funde in der Gemarkung des Ortes Lánycsók (Vorbericht). Janus Pannonius Múzeum Évkönyve 22, 1977, 137–56.

KALICZ 1985
ID., Kőkori falu Aszódon. Neolithisches Dorf in Aszód (Aszód 1985).

KALICZ 2001
ID., Der neuere Forschungsstand der Lengyel-Kultur. In: J. Regenye (ed.), Sites and stones: Lengyel culture in Western Hungary and beyond. A review of the current research (Veszprém 2001) 7–12.

KALICZ 2003
ID., Az újkőkorvégi és rézkori megtelepedés maradványai a nagykanizsai Inkey-kápolna mellett (Kr.e. 5. évezred első harmadától a 3. évezred első feléig). Endneolithische und kupferzeitliche Besiedlung bei Nagykanizsa (Inkey-Kapelle). Zalai Múzeum 12, 2003, 7–47.

KALICZ / RACZKY 1987
N. KALICZ / P. RACZKY, The Late Neolithic of the Tisza region. A survey of recent archaeological research. In: L. Tálas / P. Raczky (eds), The Late Neolithic of the Tisza region (Budapest / Szolnok 1987) 11–30.

KARLSBERG 2006
A.J. KARLSBERG, Flexible Bayesian methods for archaeological dating (Unpublished PhD thesis, University of Sheffield, 2006).

KÖHLER 2012
K. KÖHLER, A késő neolitikus lengyeli kultúra népességének biológiai rekonstrukciója. Biological reconstruction of the Late Neolithic Lengyel culture (PhD dissertation, Eötvös Loránd University, Budapest, 2012).

KÖHLER 2013
ID., Biological reconstruction of the Late Neolithic Lengyel culture. PhD thesis. Dissertationes Archaeologicae Series. 3, No. 1, 2013, 179–204.

KÖHLER ET AL. 2013
K. KÖHLER / B.G. MENDE / A. PÓSA, The emergence of tuberculosis in Late Neolithic Transdanubia. Hungarian Archaeology E-Journal, 2013 Summer.
http://www.hungarianarchaeology.hu/wp-content/uploads/2013/08/eng_Kohler_13ny1.pdf

KÖHLER ET AL. 2014
K. KÖHLER / MÁLFI / E. MOLNÁR / I. ZALAI-GAÁL / A. OSZTÁS / E. BÁNFFY / K. KIRINÓ / K.K. KISS / B.G. MENDE, A Late Neolithic case of Pott's Disease from Hungary. International Journal of Osteoarchaeology 24, 2014, 697–703. Article first published online: 5 July 2012, DOI:10.1002/oa.2254

KUČA ET AL. 2009
M. KUČA / A. PŘICHYSTAL / Z. SCHENK / Z. ŠKRDLA / P. VOKAČ, Lithic raw material procurement in the Moravian Neolithic: the search for extra–regional networks. Documenta Praehistorica 36, 2009, 313–26.

LEE / BRONK RAMSEY 2012

S. LEE / C. BRONK RAMSEY, Development and application of the trapezoidal model for archaeological chronologies. Radiocarbon 54, 2012, 107–22.

MASSON ET AL. 2014
M. MASSON / E. MOLNÁR / H.D DONOGHUE / G.S. BESRA / D.E MINNIKIN / H.H.T. WU / O.Y.-C. LEE / I.D BULL / GY. PÁLFI, Osteological and biomolecular evidence of a 7000-year-old case of hypertrophic pulmonary osteopathy secondary to tuberculosis from Neolithic Hungary. PlosOne, 2014, DOI: 10.1371/journal.pone.007825

MAJERIK ET AL. 2010
V. MAJERIK / N. LARSSON / Á. GELENCSÉR, Bátaszék–Kanizsai-dűlő/Lajvér (Tolna megye, TO 46. lelőhely. In: J. Kvassay (ed.), Évkönyv és jelentés a Kulturális Örökségvédelmi Szakszolgálat 2008. Évi feltárásairól (Field Service for Cultural Heritage 2008. Yearbook and review of archaeological investigations) (Budapest 2010) 17–18.

MINICHREITER / BOTIČ 2010
K. MINICHREITER / K. BOTIČ, Early Neolithic burials of Starčevo culture at Galovo, Slavonski Brod (northern Croatia). Documenta Praehistorica 37, 2010, 105-24.

NĚMEJCOVÁ-PAVÚKOVÁ 1986
V. NĚMEJCOVÁ-PAVÚKOVÁ, Vorbericht über die Ergebnisse der systematischen Grabung in Svodín in den Jahren 1971–1983. Slovenská archeológia 34, 1986, 133–76.

NÉMETH 1994
T.G. NÉMETH, Vorbericht über spätneolithische und frühkupferzeitliche Siedlungsspuren bei Lébény (Westungarn). A Jósa András Múzeum Évkönyve 36, 1994, 241–61.

NEUGEBAUER-MARESCH 1995
C. NEUGEBAUER-MARESCH, Mittelneolithikum: Die Bemaltkeramik. In: E. Lenneis / C. Neugebauer-Maresch / E. Ruttkay (eds), Jungsteinzeit im Osten Österreichs (St. Pölten / Wien 1995) 57–107.

NEUGEBAUER /NEUGEBAUER-MARESCH 2003
J-W. NEUGEBAUER / C. NEUGEBAUER-MARESCH 2003, Die Doppel-Sonderbestattung der Bemaltkeramik von Reichersdorf, Marktgemeinde Nussdorf ob der Traisen, Niederösterreich. In: E. Jerem / P. Raczky (eds), Morgenrot der Kulturen. Frühe Etappen der Menscheitsgeschichte in Mittel- und Südosteuropa. Festschrift für Nándor Kalicz zum 75. Geburtstag (Budapest 2003) 327–34.

NEUGEBAUER-MARESCH ET AL. 2002
C. NEUGEBAUER-MARESCH / J-W. NEUGEBAUER / K. GROSZSCHMIDT / U. RANDL / R. SEEMANN, Die Gräbergruppe vom Beginn der Bemaltkeramik im Zentrum der Kreisgrabenanlage Friebritz-Süd, Niederösterreich. Preistoria Alpina 37, 2002, 187–253.

NEUGEBAUER-MARESCH / TESCHLER-NICOLA 2006
C. NEUGEBAUER-MARESCH / M. TESCHLER-NICOLA, Zu den perimortalen Beschädigungen und postmortalen Lageveränderungen der Bestattungen von Friebritz (NÖ.) und ihre Bedeutung für die mittelneolithische Kreisgrabenanlage. In: A. Krenn-Leeb / K. Grömer / P. Stadler (eds), Ein Lächeln für die Jungsteinzeit. Ausgewählte

Beiträge zum Neolithikum Ostösterreichs. Festschrift für Elizabeth Ruttkay. Archäologie Österreichs 17/2, 2006, 31–40.

NEUGEBAUER / TRNKA 2005
W. NEUGEBAUER / G. TRNKA, Totenbrauchtum. In: F. Daim / W. Neubauer (eds). Zeitreise Heldenberg. Geheimnisvolle Kreisgräben. Katalog zur Niederösterreichischen Landesaustellung 2005 (Horn /Wien 2005) 223–4.

NYERGES 2013
É.Á. NYERGES, Preliminary report on the neolithic archaeozoological finds from Alsónyék-Bátaszék, Hungary (Előzetes jelentés Alsónyék-Bátaszék neolitikus lelőhely archaezoológiai leletanyagáról). Archeometriai Műhely 10, 2013, 209–14.

OROSS / MARTON 2012
K. OROSS / T. MARTON, Neolithic burials of the Linearbandkeramik settlement at Balatonszárszó and their European context. Acta Archaeologica Academiae Scientiarum Hungaricae 63, 2012, 257–300.

OROSS ET AL. 2010
K. OROSS / T. MARTON / A. WHITTLE / R.E.M. HEDGES / L.J.E CRAMP, Die Siedlung der Balaton-Lasinja-Kultur in Balatonszárszó-Kis-erdei-dűlő. In: J. Šuteková / P. Pavúk / P. Kalábková / B. Kovár (eds), PANTA RHEI: studies on the chronology and cultural development of south-eastern and central Europe in earlier prehistory presented to Juraj Pavúk on the occasion of his 75th birthday (Bratislava 2010) 379–405.

OROSS ET AL. this volume
K. OROSS / A. OSZTÁS / T. MARTON / K. KÖHLER / J. GÁBOR ÓDOR / A. SZÉCSÉNYI-NAGY / E. BÁNFFY / K.W. ALT / C. BRONK RAMSEY / B. KROMER / A. BAYLISS / D. HAMILTON / A. WHITTLE, Midlife changes: the Sopot burial ground at Alsónyék.

ORTNER 2003
D.J. ORTNER, Identification of pathological conditions in human skeletal remains (second edition) (San Diego 2003).

OSZTÁS ET AL. 2004
A. OSZTÁS / T. MARTON / A. SÓFALVI, Szólád–Kisaszó. In: SZ. HONTI / K. BELÉNYESY / SZ. FÁBIÁN / ZS. GALLINA / Á. D. HAJDÚ / B. HANSEL / T. HORVÁTH / V. KISS / I. KOÓS / T. MARTON / P. G. NÉMETH / K. OROSS / A. OSZTÁS / P. POLGÁR / J. P-SZEŐKE / G. SERLEGI / ZS. SIKLÓSI / A. SÓFALVI / G. VIRÁGOS, A tervezett M7-es autópálya Somogy megyei szakaszának megelőző régészeti feltárása (2002–2003). Előzetes jelentés III. Somogyi Múzeumok Közleményei 16, 2004, 61–3.

OSZTÁS ET AL. this volume
A. OSZTÁS / E. BÁNFFY / I. ZALAI-GAÁL / K. OROSS / T. MARTON / K. SOMOGYI, Alsónyék-Bátaszék: introduction to a major Neolithic settlement complex in south-east Transdanubia, Hungary.

OSZTÁS ET AL. 2012
A. OSZTÁS / I. ZALAI-GAÁL / E. BÁNFFY, Alsónyék-Bátaszék: a new chapter in the research of the Lengyel culture. Documenta Praehistorica 39, 2012, 377–96.

PALUCH 2004
T. PALUCH, A Körös–Starčevo kultúra temetkezései (Die Bestattungen der Körös–Starčevo-Kultur). A nyíregyházi Jósa András Múzeum Évkönyve 46, 2004, 23–51.

PALUCH 2007
ID., The Körös culture graves. In: J. Makkay (ed.), The excavations of the Early Neolithic Sites of the Körös culture in the Körös valley, Hungary. The final report. I: The excavations: stratigraphy, structures and graves (Trieste 2007) 247–54.

PAVÚK 2003
J. PAVÚK, Hausgrundrisse der Lengyel-Kultur in der Slowakei. In: J. Eckert / U. Eisenhauer / A. Zimmermann (eds), Archaologische Perspektiven: Analysen und Interpretationen im Wandel (Rahden 2003) 455–69.

PAVÚK 2007
ID., Zur Frage der Entstehung und Verbreitung der Lengyel-Kultur. In: In: J.K. Kozlowski / P. Raczky (eds), The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in central Europe (Kraków / Budapest 2007) 11–28.

PODBORSKÝ 1984
V. PODBORSKÝ, Domy lidu s moravskou malovanou keramikou. Die Häuser des Volkes mit mährischer bemalter Keramik. Sborník Prací Filozofické Fakulty Brněnské Univerzity E 29, 27–66.

PODBORSKÝ 2004
ID., Über das geistige Leben der Träger der Lengyel-Kultur. In: B.Hänsel / E. Studeníková (eds), Zwischen Karpaten und Ägäis. Neolithikum und Ältere Bronzezeit. Gedenkschrift für Viera Němejcová-Pavúková (Rahden 2004) 271–83.

PÓSA ET AL. 2015
A. PÓSA / F. MAIXNER / B.G. MENDE / K. KÖHLER / A. OSZTÁS / C. SOLA / O. DUTOUR / M. MASSON / E. MOLNÁR / G. PÁLFI / A. ZINK, Tuberculosis in Late Neolithic-Early Copper Age human skeletal remains from Hungary. Tuberculosis. Article published online: http://dx.doi.org/10.1016/j.tube.2015.02.011

QUITTA / KOHL 1969
H. QUITTA / G. KOHL, Neue Radiocarbondaten zum Neolithikum und zur frühen Bronzezeit Südosteuropas und der Sowjetunion. Zeitschrift für Archäologie 3, 1969, 223–55.

QUITTA / KOHL 1970
ID., Berlin Radiocarbon Measurements IV. Radiocarbon 12, 1970, 400–20.

RACZKY 1974
P. RACZKY, Alengyeli kultúra legkésőbbi szakaszának leletei a Dunántúlon. Funde der spätesten Phase der Lengyel-Kultur in Westungarn. Archaeologiai Értesíto 101, 1974, 185–210.

RACZKY 2005
ID., Újkőkori ház kísérleti rekonstrukciója Polgár-Csőszhalom településéről. Experimental reconstruction of a Neolithic house at the Polgár-Csőszhalom settlement.

Őrségészeti Levelek / Prehistoric Newsletter 7, 2005, 24–49.

RASSMANN ET AL. 2015
K. RASSMANN / C. MISCHKA / M. FURHOLT / R. OHLARU / K. RADLOFF / K. WINKELMANN / G. SERLEGI / T. MARTON /A. OSZTÁS / K. OROSS / E. BÁNFFY, Large scale geomagnetic prospection on Neolithic sites in Hungary. Hungarian Archaeology E-journal, 2015 Spring.
http://files.archaeolingua.hu/2015TA/Rassmann_E15TA.pdf

REGENYE 2004
J. REGENYE, Háztípusok és településszerkezet a késői lengyeli kultúrában veszprémi és szentgáli példák alapján. House types and settlement structure in the Late Lengyel culture, based in the examples at Veszprém and Szentgál. Veszprém Megyei Múzeumok Közleményei 23, 2004, 25–47.

REGENYE 2007
ID., The Late Lengyel culture in Hungary as reflected by the excavation at Veszprém. In: J.K. Kozłowski and P. Raczky (eds), The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in Central Europe (Kraków / Budapest 2007) 381–96.

REGENYE 2011
ID., Kő és agyag. Település és életmód a neolitikum–rézkor fordulóján a Dunántúlon. Stone and clay. Settlement and way of life at the Neolithic/Copper age transition in Transdanubia (Veszprém 2011).

RUTTKAY 1987
E. RUTTKAY, Ein Brandgrab der Lengyelkultur mit einer Henkelschale aus Ursprung, Niederösterreich. Annalen des Naturhistorischen Museums Wien, 89. Band 1985/Serie A, 1987, 211–24.

RUTTKAY / TESCHLER-NICOLA 1985
E. RUTTKAY / M. TESCHLER-NICOLA, Zwei Lengyel-Gräber aus Niederösterreich. Annalen des Naturhistorischen Museums Wien, 87. Band 1983/Serie A, 1985, 211–35.

SIKLÓSI 2010
ZS. SIKLÓSI, A társadalmi egyenlőtlenség nyomai a késő neolitikumban a Kárpát-medence keleti felén. (Traces of social inequality during the Late Neolithic in the Eastern Carpathian Basin). Unpublished PhD thesis, Eötvös Loránd University (Budapest 2010).

SOMOGYI 2007
K. SOMOGYI, Die besonderen Grabenanlagen der Lengyel-Kultur in Kaposújlak-Várdomb-dűlő im Komitat Somogy (SW-Ungarn). In: J.K. Kozłowski / P. Raczky (eds), The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in central Europe (Kraków 2007) 329–44.

SOMOGYI / GALLINA 2013
K. SOMOGYI / ZS. GALLINA, Besonderes anthropomorphes Gefäß der Lengyel-Kultur mit doppelter Gesichts- und Menschendarstellung in Alsónyék (SW-Ungarn). In: A. Anders / G. Kulcsár (eds) Moments in time: papers presented to Pál Raczky on his 60th birthday (Budapest 2013) 437–56.

STADLER / RUTTKAY 2007
P. STADLER / E. RUTTKAY, Absolute chronology of the Moravian-Eastern-Austrian Group (MOG) of the Painted Pottery (Lengyel-Culture) based on new radiocarbon dates from Austria. In: J.K. Kozłowski / P. Raczky (eds), The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in central Europe (Kraków 2007) 117–46.

TORMA 1971
I. TORMA, Neolithische Siedlung und Gräberfeld, kupferzeitliche Siedlung, bronzezeitliche Siedlung in Pári-Altacker (Vorbericht). Mitteilungen des Archäologischen Instituts der Ungarischen Akademie der Wissenschaften 2, 1969 (1971), 27–34.

TÓTH 2013
ID., Csont- és agancseszközök komplex vizsgálata a késő neolitikus Aszód-Papi földek lelőhelyén. (Complex analysis of bone and antler tools at the late Neolithic site of Aszód-Papi földek.). Unpublished PhD thesis, Eötvös Loránd University (Budapest 2013).

VIRÁG / FIGLER 2007
ZS. VIRÁG / A. FIGLER, Data on the settlement history of the Late Lengyel period of Transdanubia on the basis of two sites from the Kisalföld (Small Hungarian Plain). A preliminary evaluation of the sites Győr-Szabadrétdomb and Mosonszentmiklós-Pálmajor. In: J.K. Kozłowski / P. Raczky (eds), The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in Central Europe (Kraków / Budapest 2007) 345–64.

WARD / WILSON 1978
G.K. WARD / S.R. WILSON, Procedures for comparing and combining radiocarbon age determinations: a critique. Archaeometry 20, 1978, 19–31.

WHITTLE ET AL. 2013
A. WHITTLE / A. ANDERS / A. R. BENTLEY / P. BICKLE / L. CRAMP / L. DOMBORÓCZKI / L. FIBIGER / J. HAMILTON / R. HEDGES / N. KALICZ / ZS. E. KOVÁCS / T. MARTON / K. OROSS / I. PAP / P. RACZKY, 3. Hungary. In: P. Bickle / A. Whittle (eds), The first farmers of central Europe: diversity in LBK lifeways (Oxford 2013) 49–97.

WOSINSKY 1889
M. WOSINSKY, Lengyeli ásatások 1888-ban. Die Ausgrabungen in Lengyel im Jahre 1888. Archeológiai Értesítő 9, 331–5.

WOSINSKY 1891
ID., Das prähistorische Schanzwerk von Lengyel. Seine Erbauer und Bewohner. I-III (Budapest 1891).

ZALAI-GAÁL 1982
I. ZALAI-GAÁL, A lengyeli kultúra a Dél-Dunántúlon. (Die Lengyel-Kultur in Südtransdanubien). A Szekszárdi Béri Balogh Ádám Múzeum Évkönyve 10-11, 1982, 3–58.

ZALAI-GAÁL 1988
ID., Közép-európai neolitikus temetők szociálarchaeológiai elemzése. Sozialarchäologische Untersuchungen des mitteleuropäischen Neolithikums aufgrund der Gräberfeldanalyse. A Béri Balogh Ádám Múzeum Évkönyve 14, 1988, 3–178.

ZALAI-GAÁL 1990
ID., A neolitikus körárokrendszerek kutatása a Dél-Dunántúlon (Die Erforschung der neolithischen Kreisgrabensysteme in SO-Transdanubien). Archaeológiai Értesítő 117, 1990, 3–24.

ZALAI-GAÁL 1999
ID., A lengyeli kultúra sírjai Pári-Altackerben (Torma István ásatása 1968-ban) (Gräber der Lengyel-Kultur in Pári-Altacker /Grabung von István Torma im Jahre 1968). A Wosinszky Mór Múzeum Évkönyve 21, 1999, 1–31.

ZALAI-GAÁL 2000
ID., A györei neolitikus antropomorf edény. A Wosinszky Mór Múzeum Évkönyve 22, 2000, 7-38.

ZALAI-GAÁL 2001a
ID., Die Gräbergruppe B2 von Mórágy-Tűzkődomb und der frühere Abschnitt der Len¬gyel-Kultur. Acta Archaeologica Academiae Scientiarum Hungaricae 52, 2001, 1–48.

ZALAI-GAÁL 2001b
ID., A késői neolitikum története a Dél-Dunántúlon a temetőelemzések tükrében (tipológia – kronológia – társadalomrégészet). Akadémiai doktori értekezés (Budapest 2001).

ZALAI-GAÁL 2002
ID., Die neolithische Gräbergruppe B1 von Mórágy-Tűzkődomb. I. Die archäologischen Funde und Befunde (Szekszárd / Saarbrücken 2002).

ZALAI-GAÁL 2007
ID., Von Lengyel bis Mórágy. Die spätneolithische Grabkeramik in Südtransdanubien aus den alten Ausgrabungen. I. Analyse. A Wosinsky Mór Múzeum Évkönyve 29, 2007, 7–177.

ZALAI-GAÁL 2008
ID., An der Wende vom Neolithikum zur Kupferzeit in Transdanubien (Ungarn): die 'Häuptlingsgräber' der Lengyel-Kultur in Alsónyék-Kanizsa. Das Altertum 53, 2008, 1–40.

ZALAI-GAÁL 2010
ID., Die soziale Differenzierung im Spätneolithikum Südtransdanubiens: die Funde and Befunde aus den Altgrabungen der Lengyel-Kultur (Budapest 2010).

ZALAI-GAÁL / ÓDOR 2008
I. ZALAI-GAÁL / J.G. ÓDOR, Early Lengyel burials at Györe in southern Transdanubia. Antaeus 29-30, 2008, 535–76.

ZALAI-GAÁL ET AL. 201o
I. ZALAI-GAÁL / K. KÖHLER / A. OSZTÁS, Zur Typologie und Stellung von Kulttischchen der Lengyel-Kultur im Mittel- und Südosteuropäischen Neolithikum. Acta Archaeologica Academiae Scientiarum Hungaricae 61, 2010, 305–80.

ZALAI-GAÁL ET AL. 2011a
I. ZALAI-GAÁL / E. GÁL / K. KÖHLER / A. OSZTÁS, „Ins Jenseits begleitend“: Hunde mit Bestattungen der Lengyel-Kultur von Alsónyék-Bátaszék. Acta Archaeologica Academiae Scientiarum Hungaricae 62, 2011, 29–74.

ZALAI-GAÁL ET AL. 2011b
ID., Das Steingerätedepot aus dem Häuptlingsgrab 3060 der Lengyel-Kultur von Alsónyék, Südtransdanubien. In: H.-J. Beier / R. Einicke / E. Biermann (eds), Dechsel, Axt, Beil & Co — Werkzeug, Waffe, Kultgegenstand? Aktuelles aus der Neolithforschung (Langenweissbach 2011) 65–83.

ZALAI-GAÁL ET AL. 2012a
I. ZALAI-GAÁL / K. KÖHLER / A. OSZTÁS, Totenbrett oder Totenhütte? Zur Struktur der Gräber der Lengyel-Kultur mit Pfostenstellung in Südtransdanubien. Acta Archaeologica Academiae Scientiarum Hungaricae 63, 2012, 69–116.

ZALAI-GAÁL ET AL. 2012b
I. ZALAI-GAÁL / E. GÁL / K. KÖHLER / A. OSZTÁS / K. SZILÁGYI, Präliminarien zur Sozialarchäologie des lengyelzeitlichen Gräberfeldes von Alsónyék-Bátaszék, Südtransdanubien. Praehistorische Zeitschrift 87, 2012, 58–82.

ZALAI-GAÁL ET AL. 2014a
I. ZALAI-GAÁL / A. GRISSE / A. OSZTÁS / K. KÖHLER, Die durchbohrten Steingeräte des südtransdanubischen Neolithikums (5. Jahrtausend v. Chr.) (Budapest 2014).

ZALAI-GAÁL ET AL. 2014b
I. ZALAI-GAÁL / A. OSZTÁS / K. SOMOGYI, Zur relative Chronologie der Lengyel-Kultur im westlichen Karpatenbecken: Präliminarien zur Bayesischen Analyse. Acta Archaeologica Academiae Scientiarum Hungaricae 65, 2014, 285–334.

ZALAI-GAÁL ET AL. IN PRESS
I. ZALAI-GAÁL / K. KÖHLER / A. OSZTÁS, Ein neuer Gefässtyp der Spätlengyel-Kultur von Alsónyék-Bátaszék, Südtransdanubien. Studia Praehistorica.

ZÁPOTOCZKÁ 1998
M. ZÁPOTOCZKÁ, Bestattungsritus des böhmischen Neolithikums (5500-4200 B.C.). Gräber und Bestattungen der Kultur mit Linear-, Stichband- und Lengyelkeramik (Praha 1998).

ZOFFMANN 1968
ZS.K. ZOFFMANN, An anthropological study of the Neolithic cemetery at Villánykövesd (Lengyel culture). A Jannus Pannonius Múzeum Évkönyve 13, 1968, 25–37.

ZOFFMANN 1969-70
ID., Anthropological analysis of the cemetery at Zengővárkony and the Neolithic Lengyel culture in SW Hungary. A Janus Pannonius Múzeum Évkönyve 14-15, 1974, 53–72.

ZOFFMANN 2004
ID., A Lengyeli kultúra Mórágy B.1. temetkezési csoportjának embertani ismertetése (Anthropologische Funde des neolithischen Gräberfeldes Mórágy B.1 aus der Lengyel-

Kultur. 1991, Manuscript). A Wosinszky Mór Megyei Múzeum Évkönyve 26, 2004, 137–79.

ZOFFMANN 2014
ID., Embertani leletek a Lengyeli kultúra Mórágy-Tűzkődomb B.2 lelőhelyen részlegesen feltárt sírcsoportjából (Anthropological finds from the partially unearthed burial group at Mórágy-Tűzkődomb B.2 dated to the Late Neolithic Lengyel culture). Folia Anthropologica 13, 2014, 61–6.

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